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JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED

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JANUARY, 1830.

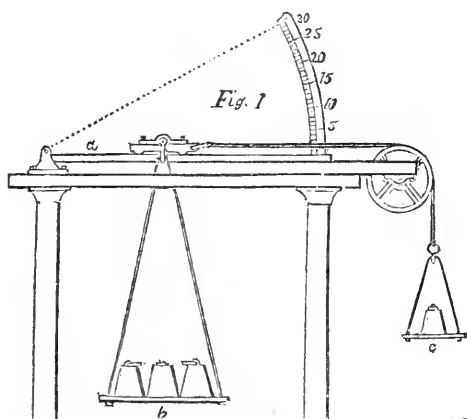
Experiments on the Friction and Abrasion of the Surfaces of Solids.

By GEORGE RENNIE, Esq. F. R. S.

From the Transactions of the Royal Society.

Continued from page 396, Vol. IV.

THE apparatus referred to, page 388 of the last volume, for performing the experiments on the friction of attrition in solids, is shown in the subjoined cut, Fig. 1, in which *a* is the platform, *b* the fixed scale, and *c* the moving scale.



From the foregoing experiments it appears that the friction of

varies from

Cast-iron upon cast-iron laid flat,	-	-	6.58 to 7.53
Cast-iron upon cast-iron laid edgewise,	-	-	6.2 to 6.5
Of hard brass upon cast-iron laid flat,	-	-	7.2 to 7.8
Of hard brass upon cast-iron laid edgewise,	-	-	6.0 to 8.0
Of yellow brass upon cast-iron laid flat,	-	-	6.09 to 7.22
Of yellow brass upon cast-iron laid edgewise,	-	-	6.1 to 7.24
Of tin upon cast-iron laid flat,	-	-	5.4 to 6.11
Of tin upon cast-iron laid edgewise,	-	-	5.09 to 6.11

That the friction is nearly the same with cast-iron and brass, whether the load be applied on the broad side or on the narrow side of the plates, although the areas of the surfaces are to each other as 6.22 : 1.

That tin being a softer metal and more easily abraded, the friction increases when a load is applied above 8 lbs. per square inch, but remains nearly the same with the broad side as with the narrow side. Generally speaking, the friction is less with the broad side than with the narrow side.

TABLE VII.—*Experiments on the Friction of different Metals with the weights increased from 14lbs. to 192.*

Weight to be moved.	Wt. required to move it.	Proportion.	Weight of 1 inch of area.
Brass on Wrought Iron.			
Length $6\frac{3}{4}$ in.		Width $\frac{7}{8}$.	Area 5.906.
lbs.	lbs. oz.		lbs. oz.
14	2 2	6.58	2 5.9
24	3 11	6.50	4 1.0
36	4 14	7.38	6 1.5
48	6 6	7.52	8 2.0
60	8 0	7.50	10 2.5
72	9 6	7.68	12 3.0
84	10 10	7.90	14 3.5
96	12 9	7.64	16 4.0
192	27 0	7.11	32 8.0

Experiments on the Friction of different Metals with the weights increased from 14lbs. to 192.

Weight to be moved.	Wt. required to move it.	Proportion.	Weight to 1 inch of area.
Cast Iron on Cast Iron. Area 6.75.			
lbs.	lbs. oz.		lbs. oz.
14	2 4	6.22	2 1.2
24	3 0	8.00	3 8.9
36	5 14	6.12	5 5.3
48	7 10	6.29	7 1.7
60	9 8	6.31	8 14.2
72	11 7	6.29	10 10.6
84	13 5	6.30	12 7.1
96	15 5	6.27	14 3.5
Soft Steel on Wrought Iron. Area 5.906.			
lbs.	lbs. oz.		lbs. oz.
14	2 8	5.60	2 5.9
24	4 8	5.33	4 1.0
36	6 13	5.28	6 1.5
48	9 5	5.15	8 2.0
60	12 6	4.84	10 2.5
72	14 13	4.86	12 3.0
84	17 5	4.85	14 3.5
96	19 4	4.98	16 4.0
192	32 8	5.90	32 8.0
Brass sliding on Steel. Area 5.9.			
lbs.	lbs. oz.		lbs. oz.
14	2 1	6.78	2 5.9
24	3 8	6.85	4 1.0
36	5 0	7.20	6 1.6
48	7 11	6.24	8 2.1
60	9 11	6.19	10 2.7
72	11 5	6.36	12 3.2
84	13 0	6.46	14 3.7
96	15 0	6.40	16 4.3
192	28 0	6.85	32 8.0

RENNIE'S *Experiments on the Friction*

Experiments on the Friction of different Metals with the weights increased from 14lbs. to 192.

Weight to be moved.	Wt. required to move it.	Proportion.	Weight to 1 inch of area.
Brass sliding on Brass. Area 5.9.			
lbs.	lbs. oz.		lbs. oz.
14	2 10	5.33	2 5.9
24	3 8	6.85	4 1.0
36	6 5	5.70	6 1.6
48	8 4	5.81	8 2.1
60	10 3	5.88	10 2.7
72	12 0	6.00	12 3.2
84	14 0	6.00	14 3.7
96	16 0	6.00	16 4.3
192	44 8	4.31	32 8.0
Cast Iron on Wrought Iron. Area 5.9.			
lbs.	lbs. oz.		lbs. oz.
14	2 4	6.22	2 5.9
24	4 2	5.81	4 1.0
36	6 2	5.87	6 1.6
48	7 12	6.19	8 2.1
60	9 8	6.31	10 2.7
72	11 5	6.36	12 3.2
84	13 13	6.08	14 3.7
96	17 0	5.64	16 4.3
192	33 8	5.73	32 8.0
Cast Iron sliding on Soft Steel. Area 5.9.			
lbs.	lbs. oz.		lbs. oz.
14	2 2	6.59	2 5.9
24	3 10	6.62	4 1.0
36	5 7	6.62	6 1.6
48	7 2	6.73	8 2.1
60	9 8	6.31	10 2.7
72	11 9	6.22	12 3.2
84	13 9	6.19	14 3.7
96	15 5	6.26	16 4.3
192	32 0	6.00	32 8.0

Experiments on the Friction of different Metals with the weights increased from 14lbs. to 192.

Weight to be moved.	Wt. required to move it.	Proportion.	Weight to 1 inch of area.
Tin sliding on Tin. Area 5.9.			
lbs.	lbs. oz.		lbs. oz.
14	3 10	3.86	2 5.9
24	7 8	3.20	4 1.0
36	9 8	3.78	6 1.6
48	12 13	3.74	8 2.1
60	17 7	3.44	10 2.7
72	22 2	3.25	12 3.2
84	28 8	2.94	14 3.7
96	36 0	2.66	16 4.3
192	66 8	2.88	32 8.0
Soft Steel on Soft Steel. Area 5.9.			
lbs.	lbs. oz.		lbs. oz.
14	2 0	7.00	2 5.9
24	3 7	6.98	4 1.0
36	5 4	6.85	6 1.6
48	6 13	7.04	8 2.1
60	8 11	6.90	10 2.7
72	10 5	6.98	12 3.2
84	12 2	6.92	14 3.7
96	13 12	6.98	16 4.3
192	31 8	6.09	32 8.0
Cast Iron on Hard Brass. Area 7.75.			
lbs.	lbs. oz.		lbs. oz.
14	1 11	8.29	1 12.9
24	4 0	6.00	3 1.5
36	6 0	6.00	4 10.3
48	7 13	6.14	6 3.0
60	9 0	6.66	7 11.8
72	11 0	6.54	9 4.6
84	13 2	6.40	10 13.4
96	14 8	6.62	12 6.1

Experiments on the Friction of different Metals with the weights increased from 14lbs. to 192.

Weight to be moved.	Wt. required to move it.	Proportion.	Weight to 1 inch of area.
Wrought Iron on Wrought Iron. Area 5.9.			
lbs.	lbs. oz.		lbs. oz.
14	2 1	6.78	2 5.9
24	3 13	6.29	4 1.0
36	5 12	6.26	6 1.6
48	7 2	6.73	8 2.1
60	9 8	6.31	10 2.7
72	11 6	6.32	12 3.2
84	12 15	6.49	14 3.7
96	14 3	6.76	16 4.3
192	27 0	7.11	32 8.0
Brass on Cast Iron. Area 6.75.			
lbs.	lbs. oz.		lbs. oz.
14	2 1	6.78	2 1.2
24	3 8	6.85	3 8.9
36	5 1	7.11	5 5.3
48	6 10	7.24	7 1.7
60	9 3	6.53	8 14.2
72	10 5	6.98	10 10.6
84	13 12	6.10	12 7.1
96	15 1	6.37	14 3.5
Tin sliding on Wrought Iron. Area 5.9.			
lbs.	lbs. oz.		lbs. oz.
14	2 10	5.33	2 5.9
24	4 6	5.48	4 1.0
36	6 8	5.53	6 1.6
48	7 14	6.09	8 2.1
60	9 13	6.11	10 2.7
72	11 13	6.09	12 3.2
84	13 15	6.02	14 3.7
96	15 13	6.07	16 4.3
192	32 8	5.90	32 8.0

Experiments on the Friction of different Metals with the weights increased from 14lbs. to 192.

Weight to be moved.	Wt. required to move it.	Proportion.	Weight to 1 inch of area.
Tin sliding on Cast Iron. Area 6.75.			
lbs.	lbs. oz.		lbs. oz.
14	2 12	5.09	2 1.2
24	4 8	5.33	3 8.9
36	6 7	5.59	5 5.3
48	8 14	5.40	7 1.7
60	9 13	6.11	8 14.2
72	11 13	6.09	10 10.6
84	14 5	5.86	12 7.1
96	16 4	5.90	14 3.5

TABLE VIII.—*A Table showing the Power required to move a weight progressively increased until the metals abrade each other.*

Weight to be moved.	Wt. required to move it.	Proportion.	Weight to 1 inch of area.
Wrought Iron on Wrought Iron. Area 6 inches.			
cwt.	cwt. qrs.		cwt.
10	2 2	4.00	1.66
12	3 1	3.69	2.00
14	4 0	3.50	2.33
16	4 3	3.36	2.66
18	5 2.5	3.20	3.00
20	7 0	2.85	3.33
22	8 1	2.66	3.66
24	9 0	2.66	4.00
26	10 1	2.53	4.33
28	11 1	2.48	4.66
30	12 1	2.44	5.00

A Table showing the Power required to move a weight progressively increased until the Metals abrade each other.

Weight to be moved.	Wt. required to move it.	Proportion.	Weight to 1 inch of area.
Wrought Iron on Cast Iron. Area 6 inches.			
cwt.	cwt. qrs.		cwt.
10	2 3	3.63	1.66
12	3 2	3.42	2.00
14	4 2	3.11	2.33
16	5 1	3.04	2.66
18	6 0	3.00	3.00
20	7 0	2.85	3.33
22	7 3	2.83	3.66
24	8 3	2.74	4.00
26	9 2	2.73	4.33
28	10 1	2.73	4.66
30	11 0	2.72	5.00
32	11 3	2.72	5.33
34	12 2	2.72	5.66
36	13 2	2.66	6.00
38	16 2	2.30	6.33
Steel on Cast Iron. Area 6 inches.			
cwt.	cwt. qrs.		cwt.
10	3 0	3.33	1.66
12	4 0	3.00	2.00
14	4 3	2.94	2.33
16	5 2	2.90	2.66
18	6 1	2.88	3.00
20	7 0	2.85	3.33
22	7 3	2.83	3.66
24	8 2	2.82	4.00
26	9 1	2.81	4.33
28	10 0	2.80	4.66
30	10 3	2.79	5.00
32	11 2	2.78	5.33
34	12 2	2.72	5.66
36	14 2	2.48	6.00

A Table showing the Power required to move a weight progressively increased until the Metals abrade each other.

Weight to be moved.	Wt. required to move it.	Proportion.	Weight to 1 inch of area.
Brass on Cast Iron. Area 6 inches.			
cwt.	cwt. qrs. lbs		cwt.
10	2 1 00	4.44	1.66
12	2 2 14	4.57	2.00
14	3 0 00	4.66	2.33
16	3 1 14	4.74	2.66
18	3 3 14	4.64	3.00
20	4 0 14	4.84	3.33
22	4 2 00	4.88	3.66
24	5 0 00	4.80	4.00
26	5 3 00	4.52	4.33
28	6 1 00	4.48	4.66
30	7 0 00	4.28	5.00
32	7 2 00	4.26	5.33
34	8 0 00	4.25	5.66
36	8 1 14	4.29	6.00
38	8 3 14	4.28	6.33
40	9 1 14	4.26	6.66
42	9 3 00	4.30	7.00
44	12 0 00	3.66	7.33

Appendix to TABLES VII and VIII.

TABLE showing the comparative amount of Friction of different Metals under an average pressure of from 54.25 lbs. to 69.55 lbs. as calculated from the foregoing experiments.			
Description of Metals.	Average weight.	Proportion.	Weight per sq. inch area.
	lbs.		lbs. oz.
Brass on wrought iron.....	69.55	7.312	11 12.4
Steel upon steel.....	69.55	6.860	11 12.5
Brass upon cast iron.....	54.25	6.745	8 0.5
Brass upon steel.....	69.55	6.592	11 12.5
Hard brass upon cast iron.....	54.25	6.581	6 15.9
Wrought iron on wrought iron....	69.55	6.561	11 12.5
Cast iron upon cast iron.....	54.25	6.475	8 0.5
Cast iron upon steel.....	69.55	6.393	11 12.5
Cast iron upon wrought iron.....	69.55	6.023	11 12.5
Tin upon wrought iron.....	69.55	5.846	11 12.5
Brass upon brass.....	69.55	5.764	11 12.5
Tin upon cast iron.....	54.25	5.671	8 0.5
Steel upon wrought iron.....	69.55	5.198	11 12.4
Tin upon tin.....	69.55	3.305	11 12.5

Remarks on TABLES VII. and VIII.

1. From the preceding experiments it appears, that the friction of metals varies with their hardness.

2. That the hard metals have less friction than the soft ones.

3. That without unguents, and within the limits of 32 lbs. 8 oz. per square inch, the friction of hard metals against hard metals may very generally be estimated at about one-sixth of the pressure.

4. That within the limits of their abrasion the friction of metals is nearly alike.

5. That from 1.66 cwt. per square inch to upwards of 6 cwt. per square inch, the resistance increases in a very considerable ratio, being the greatest with steel on cast-iron, and the least with brass on wrought iron, their limits being as 50, 36, 38, and 44 cwt. An experiment was made with a weight of 10 tons per inch on hardened steel, which abraded.

The remarkable property of steel in hardening, and its power to resist abrasion, render it preferable to every other substance yet discovered in reducing the friction of delicate instruments, as is exemplified in the different experiments on the pendulum, and the assay and other balances recently introduced at his majesty's Mint and the Bank of England.

The experiments of Messrs. Cavendish and Hatchett in the years 1798 and 1801, at his majesty's Mint, on the alloys, specific gravity, and comparative wear of gold coin by friction, likewise prove that friction and abrasion were less in the hard than soft metals. *Philosophical Transactions for 1803. Part I.*

[TO BE CONTINUED.]

ENGLISH PATENTS.

To JOHN APPLGARTH, Printer, for improvements in Block Printing.

Dated January 26, 1828.

THE improvements for which this patent has been granted, are produced by an apparatus, which will facilitate the accurate arrangement of the square blocks employed in calico printing, when used successively for the continuation of a given pattern. This apparatus is composed of two principal divisions, the first being of the nature of a table or stand, on which the calico, or other stuff required to be printed, is to be laid to receive the impression of the blocks; and the second consisting of a frame, that fulfils the chief purpose of the object of the patent.

The table, or stand, is made of horizontal stone slabs, a little exceeding the breadth of the stuff, and of the same length, (as represented in the drawing belonging to the specification,) being intended for printing handkerchiefs, or shawls. These slabs are placed successively in one line, within about an inch of each other, on parallel brick walls, of between two and three feet in height, and over them a thick piece of blanket, or other proper woollen stuff is laid, which

is either nailed to pieces of wood fixed beneath the intervals between the stone slabs, or is kept down by metal rods placed across in the same intervals, and passed through staples secured to the walls at each of their ends. A frame is then prepared to lay over this table, containing as many square compartments as there are slabs, which is fastened at one side of the table to hinges, that project from each of the supporting walls for that purpose, which allow the frame either to lie horizontally in close contact with the slabs, or to be raised up vertically, when the calico or other stuff is being laid on the slabs, or removed from them. At one extremity of this table of slabs a row of tenter hooks is placed across, to which one end of the piece to be printed is fixed, and it is then laid evenly over the slabs, and fastened down in the intervals between them by the rods passed through the staples before mentioned, after its farther end is drawn tight by means of a cross bar of wood, to which it is attached by a similar row of tenter hooks, that is either fastened to the other end of the table by cords, or is drawn towards that end by weights attached to the extremities of the same cords.

Supposing the calico, or other stuff, to be properly arranged, and fastened down evenly over the table of slabs, and the frame to be let down horizontally in contact with its surface, a block is then to be taken, having a fourth of the area of one of the square compartments of the frame, on which the pattern preferred has been cut, so that the joinings of the figure may fit accurately, on shifting its position; and the colour having been applied to its face, either by dipping it on the colour-sieve, or by colour-rollers, it is then to be pressed down by a blow or other means, in one corner of the first square compartment of the frame, then in the next corner, and so on successively through the other remaining corners; care being taken to keep the proper angle of the block next the corners of the compartment; one handkerchief or shawl being thus stamped, the same process is to be repeated in all the other compartments of the frame, until the whole piece is completed.

When a medallion, or other central figure, is to be impressed on the middle of the handkerchief, or shawl, then a moveable frame is to be formed of four pieces of wood, of the length of one of the compartments, crossed so over each other (by dividing the joinings) as, when laid in the compartment, to divide its area into nine equal squares; in the central square of these, a block, having the whole of the intended medallion, or other figure, cut on its face, is then to be stamped in the manner before described; or a block having a quarter of the same figure cut on it, (and of course of only a fourth of the area of the central square,) may be used; and the impression be made of the whole figure by four successive operations, in the same way as with the larger blocks in the process first recited.

When only a border is to be stamped on a shawl or handkerchief, the patentee directs that a block of another shape be used; which is to be of the breadth of the intended border, and of such a length as to extend from one angle of the square compartment of the guiding frame to within a distance equal to its breadth of the adjoining angle;

and the pattern proper for the angle of the border, having been cut at the end of the block, placed in the first instance close to the angle of the square compartment; at the next transfer, that end of the block is to be laid in the space left at the extremity of the first impression, where it will form the second angle of the border, and the block being applied successively at the other sides of the compartment in the same manner, will at the fourth impression complete the border.

Obs.—It appears to us, that the improvements of the patentee would very much facilitate and accelerate the operation of block printing, besides increasing the accuracy with which the joinings of the impressions would unite so as to form a perfect uniform design, or pattern: but on the other hand we understand that the process of printing piece goods by rollers, both engraved, and cut so as to act like blocks, has been brought to such perfection, and so much excels in rapidity of execution and precision, any thing that can be done by the manual application of blocks, as to leave the patentee but small chance of superiority in the competition with a rival of so much power and excellence.

[*Rep. Pat. Inven.*]

To JONATHAN BROWNILL, Cutler, for an improved method of Transferring Vessels from a Higher to a Lower Level, or from a Lower to a Higher Level, on Canals; and also for the more conveniently raising or lowering of weights, carriages, or goods on rail-roads, and for other purposes. Dated 1st May, 1828.

IN the method of passing boats from one level of a canal to another, proposed by the patentee, the upper level is made to approach close to the vertical line over the end of the lower level, by banks properly constructed and faced with masonry, which advance somewhat more than the length of a canal boat, at each side of the lower level, at the same height as on the upper level, where the masonry forms walls at both sides, similar to those of a canal lock. A water tight caisson is then prepared sufficiently longer than the boat to receive it within its bounds, and a vertical paddle or sluice, running in grooves, is formed at its two ends, which two paddles, when let down, enclose the boat and the body of water in which it floats, so as to retain the latter without leakage; strong frame work is then erected on the two walls at each side of the end of the lower level, on which the axles of large vertical grooved wheels are supported parallel to the canal, so that the edges of the wheels may project at both sides some distance beyond the banks; which in that part are either made entirely of masonry, or at least very nearly so, to enable them to have sufficient strength to support the loads they have to bear, without being broader than is absolutely necessary for this purpose; two at least of the grooved wheels must be placed as mentioned on each of these walls, and over them ropes are to be passed

from the caisson that holds the boat, to two other caissons, of about the same length, but of only about half its breadth, which are solely to hold water sufficient to balance that in the former; these two small caissons are to be sustained by the ropes, at the top near the wheels, when the large caisson is in the lower canal; and, on the contrary, when the large caisson is at the top opposite to the upper level, they will then lie at their lowest depth, descending at the opposite sides of the vertical banks as the former becomes elevated.

Paddles or sluices are fixed across in grooves, similar to those in the large caisson, at the termination of the upper level of the canal, and at the end of the lower level, close to the entrance of the space between the banks, and when the caisson is brought opposite to either of them, its end is pressed so close to it, (by means that will be described,) that the space between them will retain water; and a small paddle being first raised in the large paddle of the canal to let the water into this intervening space, the two large paddles of the great caisson and of the canal level next adjoining are then elevated, and the boat is either passed from the caisson into the level, or from the latter into the former, as the occasion may require.

To prevent the counterpoising smaller caissons from descending irregularly, on the axles of the large grooved wheels, a very large toothed wheel is directed to be fixed at each side, of sufficient size to enable the two to meet over the middle of the intervening canal, and interlock with each other, so as to make the axles at the different sides turn round simultaneously in opposite directions; the patentee adds afterwards, that the same effect may be produced by other arrangements of intermediate wheels, if that mentioned should appear objectionable.

In the disposition of the apparatus that has been described, provision is only made for the equilibrium of the counterbalancing smaller caissons with the large one that is to receive the boat: but to cause either of the weights, thus equipoised, to descend, for the above purposes, something more is necessary; this requisite, the patentee asserts, will be obtained by constructing the large caisson with a "false bottom," so as to divide it horizontally into two compartments, the upper one of which will act as has been stated, while the lower one is used as an additional balancing vessel, by pouring water into which, the large boat caisson over it may be made to preponderate, when it is desired that the boat should pass from the upper to the lower level; and on the contrary, by letting water flow from it, the boat caisson will be made to rise, and convey the boat from the lower to the upper level, when this is necessary, by the preponderance of the smaller counterbalancing caissons, which will then occur.

We now come to the contrivance for pressing the end of the boat-caisson against the frame of the sliding sluices, or paddles, at the ends of the different levels of the canal, before alluded to, which paddles perform the offices of lock gates; for this purpose a balance lever with unequal arms is placed at each end of the boat-caisson, the shorter arm of which is furnished with a friction roller, which the

longer arm by its greater weight causes to rise to a level with the centre of motion, when not counteracted; this latter arm points inwards towards the middle of the caisson, where its end is supported, when at rest, by the short horizontal arm of a bent lever, the longer arm of which rises vertically along the side of the caisson, so as to come conveniently within reach of the person who conducts the operation of the apparatus. The shorter arm of the first balance lever will, of course, from what has been stated, project outwards from the end of the boat, where its roller will come in contact with the slope of a double vertical inclined plane made at the end of the inclosed space that connects the two levels, opposite to the sluice, against which the caisson is required to be pressed; so that when, for example, the caisson is rising towards the upper level, the roller of the balance lever at the end of it opposite to the upper level will be pressed downwards, as it comes in contact with the lower slope of the double inclined plane, until it has passed the angle where the two slopes meet, when it will again descend to its former level; at which time, as before noticed, the long arm of the balance lever is supported by the horizontal arm of the bent lever; at this crisis some water is to be admitted into the lower compartment of the large boat-caisson, to cause it to descend again a small space; which will make the roller pass down the upper slope of the inclined plane, and press the caisson in the opposite direction against the paddle frame of the upper level, with the whole force of the weight of this caisson, (the long arm of the balance lever being prevented by the means mentioned from descending, so as to yield to the action of the pressure on the short arm.) The method by which the balance lever and its roller, that is placed at the other end of the boat-caisson, operate in pressing this caisson against the paddle frame of the lower level of the canal, is the same as that described; with the exception of the long slope of the inclined plane, that acts on the roller, being uppermost, and of course on the same level with the lower paddle frame and opposite to it, and that, when the pressure is required, water must be let to flow from the lower compartment of the boat-caisson, to make it ascend a short distance, in order to produce the impulse necessary: in both cases padding, or stuffing, is advised to be used between the lines of contact of the boat-caisson and the paddle frames, but no directions are given as to the formation, or peculiar arrangement of this padding. It will be observed that, when the caisson is pressed against the paddle frame of either levels, it is in a manner locked in that position by its own weight; so that some force will be required to remove this tendency, when the caisson is required to pass in the direction contrary to its former movement; but this force is readily supplied by the conductor by means of the long vertical arm of the bent lever; by hauling which he causes its short arm to ascend, that then elevates the long arm of the balance lever, and thereby forces the roller on its short arm past the angle of the double inclined plane. The patentee is aware, that the momentum of the descending caissons, when the apparatus is in action, should be counteracted at the end of each course, but he makes no other pro-

vision against this, than having a basin, or tank, of water, placed under each of the smaller counterbalancing caissons, into which their momentum will cause them to plunge some distance at the termination of their descent, from which depressure the counterbalancing weight will again speedily elevate them: and when the boat-caisson descends, the water in the lower level of the canal, into which it is to enter, will have a similar effect in counteracting its momentum. There is a reservoir placed at each side of the canal to supply water by pipes furnished with cocks, to the under compartment of the boat-caisson, when necessary, which, however, appears to us to be superfluous.

The second object of this patent,—of passing carriages and goods from one level of a rail-road to another—is effected by a water-counterpoise, in a manner similar to the preceding; a platform being prepared on which the carriage is drawn, which is then elevated to a higher level, when this is required, by two cisterns suspended by ropes over grooved wheels, supported at each side as before; into these cisterns water is let to run from higher reservoirs, until the weight of the whole is sufficient to counterbalance that of the platform, and of the carriage with its load placed on its surface; when, on the contrary, the carriage is to be brought down from the higher to the lower level, after it is drawn on the platform, previously raised up for that purpose, water is let out of the counterbalancing cisterns until the platform and its load preponderate. To this latter apparatus a contrivance is added for economising the water of the reservoir, which consists in placing three reservoirs, at different elevations, near the upper level of the rail-road, all of which communicate by pipes furnished with cocks, with a horizontal tube, that runs across from one system of reservoirs to the other. When the platform, with the carriage, is to be raised, water is first ejected from the two upper reservoirs into the two counterbalancing cisterns; the cocks of the former are then to be opened, until the level of the water within them becomes equal, and are to be then again closed; after this, water is admitted into the descending cisterns from the second two reservoirs; and again from the lowest pair in their turn, when the cisterns come down to their level. And when the platform is to descend, the water is to be let to run out of the counterbalancing cistern, first into the lower pair of reservoirs, next into the middle pair, and lastly, into the upper pair, as the cisterns ascend successively to their levels; the same management of the cocks belonging to their pipes of communication being observed on this occasion, as in the former instance.

The patentee finally observes, that an apparatus on the same principle as the last, may be used instead of a crane, for raising goods into warehouses, or taking them out of ships or carts, as well as for many other similar purposes.

Obs.—An apparatus for passing boats from one level of a canal to another, formed on the same principles as that of Mr. Brownill's, was erected in 1809, by Mr. Woodhouse, on the Worcester and Birmingham canal at Tardebig, near Broomsgrove, and was worked

experimentally for some hours every day for nearly a month in 1811. It was reported to perform very well, passing, on an average, nearly 60 boats in six hours, one-half loaded with from 15 to 20 tons, and the other half empty: and it was thought, that had the tunnel of Tardebig been completed in time, this ingenious engine would have been employed permanently; but as the canal company were obliged to use a steam engine to fill their summit level until the tunnel was completed, which superseded the use of the machine for that time, and for other reasons that were never explained satisfactorily by them, the machine was never used by the company in the transfer of goods.

The particulars in which the present patent apparatus differs from that of Mr. Woodhouse, consist in the employment of caissons of water in place of a mass of bricks, as a counterpoise to the boat and its load, and in using two sets of grooved wheels, one at each side of the canal, instead of the single set employed at one side at Tardebig: but the large caisson that held the boat, and the mode of passing the latter into it, and out of it, from and to the different levels, was the same as that which the present patentee proposes to use, as well as the counterbalancing principle on which the engine was worked.

Mr. Woodhouse used a contrivance for compensating the increased weight, caused, at the different sides of the apparatus, in the ascent and descent of the boat, by the connecting chains increasing in length at the descending side; but the present patentee has nothing of this nature in his engine; nor does he employ any means to prevent the accelerated velocity of the preponderating weights when put in motion; and it appears to us, that his manner of finally disposing of this velocity, by letting the caissons souse down into water, is a very rude and inadequate method. We also think, that his using ropes for connecting the caissons, at the different sides of the grooved wheels, is very objectionable, as the changes of the weather would be perpetually altering their length; which would produce serious inconvenience, and cause them to be neither so durable or so cheap, ultimately, by many degrees, as the chains used for the same purpose by Mr. Woodhouse.

We have already mentioned that we consider the reservoirs, for filling with water the under compartment of the boat-caisson, to be superfluous, and our reason for this is, that the upper level of the canal might be made to serve the same purpose, unless such extreme economy of water were thought necessary on this occasion, as is proposed for the rail-road transferrer. We have, however, less hesitation in thinking the compartment (or, in fact, the fourth caisson) under the boat-caisson, to be unnecessary, since it is very evident that the same effect might be produced without it, by increasing or diminishing the water in the counterbalancing caissons, as might be required for their ascent or descent.

We can say nothing in favour of the application of a water counterpoise for transferring carriages, on the different levels of rail-roads, as we imagine that it would be attended with much needless ex-

pense and complication for an operation, that may be performed much better by inclined planes and *dry* machinery. A water counterpoise may, however, we think, be used to advantage instead of a crane, as proposed by the patentee, though his method is far from being the best for the purpose. [Ib.]

To JOHN HAGUE, *Engineer, for his having invented certain improvements in the method of expelling the Molasses or Sirop from Sugar.*
Enrolled December, 1828.

THERE are two modes proposed by the patentee of extracting the molasses or sirop from sugar; the one is by producing a vacuum or exhaustion of the air under the sugar, by which the weight of the air above will be enabled to cause the liquid part to precipitate through, and leave the sugar dry; the other is by condensing the air above the sugar, and by its mechanical force producing the same effect.

Various forms and constructions of apparatus may be applied to this purpose, and the patentee, therefore, does not confine himself to any one in particular, the improvement consisting in the employment of a false bottom to the pan or vessel in which the sugar is to be operated upon.

This false bottom is to be made of copper, with perforations all over it like a colander, and placed a few inches above the real bottom of the vessel; upon the false bottom a straining cloth is to be laid, and the sugar spread a few inches thick upon the cloth.

The lower part of the vessel below the false bottom being air tight, a pipe from an air pump is to be introduced into the vessel under the false bottom, and the pump being put in action by any convenient means, as by a hand lever, or by connexion to a steam engine or water wheel, the air between the false and real bottoms will be drawn out, and a vacuum thereby produced. The pressure of the air above will then cause the molasses to pass through the sugar, and through the straining cloth, and having descended through the perforations to the bottom of the vessel, may from thence be occasionally drawn off by a pipe, with a cock inserted into the bottom of the vessel, leaving the dry sugar above.

It is unnecessary to describe the construction of an air pump, as that is well known, and a vessel of any convenient form with a perforated false bottom will answer the purpose, provided the sugar is so spread as to cover the bottom completely; and the operation will be further promoted by occasionally sprinkling a little water, or water impregnated with lime, upon the upper surface of the sugar.

The upper part of the vessel being closed, an air pump may be employed to force in a quantity of air, which becoming condensed above the surface of the sugar, will force the molasses and other liquid parts through the sugar into the lower vessel, as above described.

Either of these operations may be performed, or both may be brought into action together, and the molasses will by these means

be more effectually extracted from the sugar, than by any other process heretofore employed.

[*London Journal.*]

To GABRIEL DE SORAS, Gentleman, and STACEY WISE and CHARLES WISE, Paper-makers, in consequence of a communication made to them by a certain foreigner residing abroad, for an invention of certain improvements in Sizing, Glazing, and Beautifying the Materials employed in the Manufacture of Paper, Paste-board, Bristol-board, and other substances. Enrolled February, 1828.

FOR the purpose of sizing paper, it is proposed to employ a fluid compound of alkalies dissolved in water, with bees' wax and alum. The mode of preparing this size, is, by first making a lie of quicklime and alkaline salts, such as pearlash, potash, or carbonate of soda, which are to be dissolved in water in a wooden vessel—deal is to be preferred; the strength of the lie may be known by its specific gravity. It is proposed to use it for the present purpose at 104, distilled water being 100.

Any quantity of this lie being put into a copper boiler, and made hot, add to it as many pounds weight of fine bleached bees' wax as there are pounds of the lie, and boil them well for some hours. But it is considered that steam heat will answer better than fire.

When the wax is properly dissolved and mixed with the lie, introduce four gallons of boiling water for every pound of wax, and let them be well stirred until fully combined. If the wax be not perfectly dissolved before introducing the boiling water, a small additional quantity of alkali should be employed, which will effect the object.

To the fluid thus prepared a quantity of the farina of potatoes is to be added, or potato starch, in the proportion of four pounds of the flour in a dry state to every pound of wax; and this, when properly incorporated and become cold, constitutes a size suited to the purpose under consideration.

The patentee says that he proposes the employment of potatoes, or potato starch, only in consequence of its cheapness, as other farinaceous matter would do equally well; and he states that the potatoes are prepared by boiling and bruising them, and after straining the farina from the skins and fibrous matters (which are thrown away,) the water is evaporated, and the flour dried in any convenient manner.

The size formed as above, is to be mixed with the rags which constitute the pulp in the vat, in the way that size is commonly introduced, when the paper is not intended to be sized in sheets, and with it is to be used a quantity of alum dissolved in the water and size contained in the vat. The proportions of alum to the other materials will depend upon circumstances, which will be known to paper-makers, and, therefore, need not be particularly stated.

Paper thus sized in making, will, when pressed in sheets, assume a glossy and beautiful appearance. The mode of pressing may be

nearly the same as is commonly adopted by paper-makers. Sometimes the patentee presses the sheets between sheets of unsized paper, which has been steeped in a strong solution of alum, and at other times he presses them between felts which have been so steeped. These felts will require to be frequently washed, for the purpose of cleansing them from the size which they may take up by the operation.

The sheets of paper will require to be opened and separated at least twice during the pressing process, and when dried, will be found to possess a beautiful gloss, as above said. [B.]

To WILLIAM POWNALL, Weaver, for his new invented improvements in making Healds for weaving purposes. Enrolled July, 1828.

THERE are two methods proposed by the patentee of forming the healds for weaving; the first is by tying the knots of the cords or heald yarns alternately above and below, so as to prevent the knots from obstructing the free passage between the healds; the second is by constructing the healds of cloth, or such material woven in a peculiar way.

The method of forming the first kind of heald is by providing a bench, as many feet in length as the intended heald is to be wide, and of a width equal to the height of the intended heald. Blocks are to be placed at each end of the bench, for the purpose of supporting the two rails of the heald which is about to be formed, and raising them up a few inches, that the hands of the workmen may pass conveniently above and below. A rod is to be placed along the bench, resting upon the blocks, midway between, and parallel to, the two rails.

Two workmen are now to be seated, one on each side of the bench; one passes the heald cord over the rail on his side, and over the rod, and bringing it back to the rail, secures it; the other passes his cord in a similar way over the rail on his side, and through the loop formed by the first cord, then ties the knot to make the cord secure. The second workman then passes a cord from the rail over the rod and back again, and the first workman carries a cord from his rail through the loop, and then makes it fast by a knot. Thus the cords of the heald are alternately tied on the upper and under side of the rod, which is to form the eye. This constitutes the first improvement.

In making the healds of woven cloth, the mode proposed is to weave in a loom, a cloth or material made by shoots of suitable yarn in a warp of a length just sufficient to reach from one headle or heald rail to the other.

In weaving this material, a few inches of strong yarn is first to be shot through the warp, then a finer yarn, and then worsted, which being elastic, is to receive the eye of the heald for guiding the warp thread or yarn when the heald is made and applied. Next to the worsted some shoots of fine yarn are to be placed, and then the strong yarn as before.

The fabric thus made is to be properly stiffened, and then cut into

strips of one-tenth of an inch each, which strips being tied up to the head rails, constitute the improved head of the second kind proposed under this patent. [*Ib.*]

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN OCTOBER, 1829.

With Remarks and Exemplifications, by the Editor.

1. For a *Machine for Cleaning the Dirt, &c. from Seed Cotton*; James Gilliam, Carroll county, Tennessee, October 10.

A hollow drum, of six feet in length, and 20 inches in diameter, is made to revolve, in the manner of a bolting screen; but with its axis horizontal. Its periphery is formed by slats of wood, extending from end to end, and having a space of about half an inch between them. This drum is contained within a trough, or box, and rests upon friction rollers, upon which it revolves, as it is without gudgeons. A shaft extends through the centre of the drum, and is supported upon gudgeons outside of its heads; four boards are affixed by their edges to the shaft, and extend the whole length of the inside of the drum, forming wings, or leaves, standing at right angles to each other; upon the edges of these wings are placed, obliquely, flat pieces, to serve as conveyers, causing the seed cotton to pass from one end of the drum to the other. The shaft, with its wings, revolves much more rapidly than the drum. The cotton is put into a hopper, and in passing from one end of the drum to the other, is cleaned.

The claim is to "the whole of the above described machine."

2. For an improvement in the *Manufacturing of Gentlemen's Stocks*; G. R. Lillibridge, New York, October 10.

The foundation, or stiffening part of this stock, is formed of two pieces, joined together lengthwise, say of doubled buckram. They are to be so joined that they move on each other, as on a hinge, and are hence called "Hinge Stocks." When thus formed, they are to be covered and lined in the usual way. The buckram may be rendered water-proof, by shellac varnish. The claim is to "the composition, and manner of forming the hinge, by which the two component parts of the foundation of the stock are united together, by which the same is rendered sufficiently pliable, without the possibility of becoming displaced by ordinary wear."

3. For an improvement in *Making Combs*; Eli Sperry, New Haven, Connecticut, October 10.

A quilled back comb is to be made of wood, the grain running with the teeth of the comb; a tube of metal, the bore of which exactly fits the back of the comb, is then drawn over it, and cemented or

not, as may be thought best; there must, of course, be an opening along the tube to allow for the thickness of the teeth of the comb. The claim is to "the hollow wire tube."

On the 14th of April, a patent was obtained by Nathaniel Bushnell, of Connecticut, for manufacturing quill backed combs of wood, by making the back and teeth in separate parts, with the grain in each running longitudinally, the part forming the teeth being let into a groove in the back; this appears to us preferable to the plan now proposed.

There is not any drawing accompanying this specification; the patentee may say that it can be perfectly well understood without one; but the law says, "and shall accompany the whole with drawings and written references, whenever the nature of the case admits of drawings."

4. For an improvement in *River Dams*, for the easy passage up and down of fish, and of vessels; Patrick M'Grath, Philadelphia, Pennsylvania, October 10.

If we understand the description of this improved mode of forming dams, it consists in making the dam, on the descending side, in the form of a plane but little inclined to the horizon, so that the water in passing down shall run with but little velocity. The claim is to "an easier communication between rivers and dams, for fish, vessels, &c."

5. For an improvement in the *Application of Power to Machinery*; Robert Mitchell, Cynthiana, Harrison county, Kentucky, October 10.

This patent is for one of those outrages upon the A, B, C of mechanics, which might astonish us were they not so frequently perpetrated. The screw of Archimedes is to be made to elevate iron balls of 200 lbs. each, which are to fall upon a bucket wheel, near its top, and be delivered at the bottom into a trough, down which they are to run into the "Elevator." "The power of one horse will run the elevator with twelve balls weighing 2400 lbs.; this weight applied on the side of a wheel 30, or any other convenient number of feet in diameter, may be applied to the running of any kind of machinery," says the patentee, and no doubt he is correct, provided his machinery does not require more than the power of half a horse to turn it.

If power is to be thus gained, why fatigue and feed the horse? a little of this swindled power may as well be applied to the turning of the elevator, and the circulating medium of iron be thus rendered perpetually current.

6. For a machine called "the Queen Washer," for *Washing of Cloths* and clothing, and scouring the same; Pinkham Mosher, Milton, Saratoga county, New York, October 10.

This royal washing machine bears a strong resemblance to some of its cotemporaries, as other royal personages are found strongly to resemble the less elevated of their species. By quoting a part of our notice of the last washing machine mentioned by us, we should furnish a tolerable description of the present. There is a circular segment furnished with rollers; upon these rollers the clothes are to be placed, when they are to be acted upon by rollers placed upon a swing frame, suited to the lower segment. (See the account of Cherry's washing machine, p. 402, of the last number.) We may also quote the concluding remark of that notice, as it applies to the specification of the present patent. "There is no claim either general or particular."

7. For a *Machine for Sawing Shingles*; Richard M. Ombler, Galway, Saratoga county, New York, October 10.

Thirty-five well filled pages of foolscap are occupied with the description of this machine, although the instrument itself is not very complex.

Numerous patents have been obtained for shingle machines, some of which strongly resemble the present, and are in successful operation. A circular saw is driven by a whorl and band; the block from which the shingles are to be sawed is fixed by dogs, or holdfasts; the carriage upon which it is secured is made to traverse backwards and forwards, and a cant is given to the block, to regulate the thick and thin end. The claim is to "the application of springs and cords, in the manner described, to produce the feeding of the shingle block, up to the saw, and the readjustment of the carriage after a shingle is sawed." The peculiar mode in which the gauges are fed which regulate the thickness and shape of the shingles. The mode of drawing back the block piece, &c. of the carriage after the shingle block is sawed up. The mode of ungearing the machine when the shingle block is sawed up. The peculiar construction of the cog wheel by which the carriage is impelled forward until a shingle is sawed, and then permitted to return by the vacancy on said cog wheels.

We have not thought it necessary to attempt a description of these respective parts, because they do not appear to us to possess much either of novelty or of merit in the combination.

8. For an improvement in the *Rubbing Down and Polishing Combs* by "twin buffs;" Lewis B. Prindle, and David Curtis, Fairfield, Connecticut, October 10.

Instead of using one buff, in the ordinary way, the patentees cause two circular buffs to revolve in reverse directions, with their faces in contact; these buffs are covered with some spongy material, and are charged with pulverized English brick, for rubbing down, and with rotten stone for polishing, or with any substances possessing similar properties. Between these buffs, the backs of the combs to be rubbed down, or polished, are to be held.

It is unnecessary to describe the mode of driving the mandrels upon which the buffs are placed, as any workman can effect this. The novelty for which the patent is taken, is, manifestly, the twin buffs.

9. For an improvement in *Bilgeways*, called "Frame Bilgeways," for the purpose of drawing out of the water, and relaunching, ships and other vessels; John Thomas, New York, October 10.

The frame bilgeways consist of two longitudinal timbers, with nine cross timbers of solid oak crossing them at right angles, and securely bolted to them; five of these nine pieces project beyond the longitudinal pieces. The patentee says, "it may be proper for me to describe the common bilge-way, which is as follows: the common bilgeways are large square pieces of timber, extending nearly the length of the vessels to which they are applied, one of which timbers is placed on each side underneath the bottom of the vessel intended to be launched, or hauled up, leaving the fore and after part of the vessel unsupported."

"The principle, or character, which distinguishes the improvements I have made in the construction of the Frame Bilgeways for drawing out of the water for repairs and relaunching, ships and other vessels, consists in this: the cross timbers uniting the length-way timbers at right angles, do thereby compose a frame on which the keel and the bilge of the vessel are always supported, and which constitutes the Frame Bilge-way. On the projecting parts of the long cross timbers will be the support of the sides, and the upper parts of the vessels."

10. For an *Eight Barrelled Percussion Gun*; Samuel L. Faries, Middletown, Butler county, Ohio, October 10.

We have described several guns for which patents have been obtained, which were provided with a revolving breech, containing four or more chambers to be loaded at one time, and successively brought to coincide with the main barrel, and have spoken of the difficulties attending their employment. The present patentee is more bold than his predecessors, as he proposes to adapt a similar contrivance, not to rifles merely, but also to cannon. He has a revolving breech consisting of eight chambers, united together so as to form radii, each being furnished with its touch hole. This radiating breech turns, with play, on a centre pin, so that each chamber may in succession be brought to coincide with the main barrel, against which it is to be pressed by a screw bearing against the end of its opposite chamber. A percussion lock is to fire the piece.

Should a piece of ordnance of this description be manufactured, we should stand aloof at the time of proving it; for although the cheeks between which the breech is to revolve, and also the end in which the screw works, are to be cast solid with the body of the gun, we

fear that those behind would be in as much danger from the breech, as those before from the ball. A cannon divided transversely, and held together by a screw behind, even supposing no actual fracture to take place, would open the joint every time it was fired, from the power of the recoil, and the vibratory motion experienced by every part of it. The percussion lock for cannon is not that simple thing which answers for small arms; upon this we might offer many remarks, but must defer them for a time. The rifle which Mr. Faries has represented in his drawing, although less objectionable than the great guns, is not, we apprehend, altogether free from the difficulties which have been encountered, but not overcome, by its predecessors.

11. For a mode of *Raising Vessels out of Water*, called the "Screw Dock;" Elisha Turner, Rochester, New York, October 10.

In the construction of this dock, as represented in the drawing, a slip, or pier, is formed by driving rows of piles; and these inner rows are to be framed and braced to other rows of piles driven at a suitable distance outside of the former. Upon these a second frame is to be constructed of a height sufficient for the raising of a vessel. Through the strong upper timbers of this frame, screws are passed, the heads of which rest upon the frame, their shanks extending down and working into female screws firmly fixed in the tops of vertical sliding pieces. To the lower ends of these sliding pieces are framed beams, or bearers, extending from one side of the dock to the other, the beams thus attached to opposite slides, serve, unitedly, as a cradle to sustain the vessel, which is to be floated in over them, and raised by the screws.

To us, this screw dock appears to be in some points inferior to those formerly patented, particularly in the fixing of the nuts in the tops of the slides, where it will be difficult to secure them so as to sustain the enormous weight which they are intended to bear. Perhaps the patentee may have some superior mode of doing this, but if so, he has not explained it. The drawing gives no aid for understanding the details, as it is very indifferently executed. The inventor says, "I claim as my invention and improvement the above described new method of placing and securing the screws employed for raising vessels by means of two frames placed one on each pier, and by means of posts and slides prepared and placed in the manner above described, so that the screws may be wrought wholly out of water, and be turned by machinery placed upon the frames erected upon the piers."

"The inconveniences experienced from working screws under water are many and great, and by this improvement are avoided, and the screws made to work much more securely, and much easier; and the labourers, and the machinery used to turn the screws, are placed in a much more convenient situation while employed in raising the vessel."

12. For an improvement in *Bell Hanging*; James Russell, New York, October 10.

The particular arrangement of the parts of this apparatus cannot be explained without a drawing. The object proposed is to save room, and make one bell answer for a number of apartments. A box, or case, is fixed in the room containing the bell; within this box there are a number of sliding bars corresponding with the number of apartments from which bell wires are to extend. There are also in this box a number of plates of metal, equal to the number of sliding bars, or of wires; these plates are so constructed, that when a wire is pulled, one of the plates of metal tilts, by the action of its corresponding bar, and a disk, attached to it, having the number of the room on it, projects through a groove formed in a brass plate at one end of the box, and thus indicates the apartment where the servant is wanted. Each of the bars is made to act upon the same bell, and when a second wire is pulled, it replaces the index of the former, as its own is displayed.

The contrivance is ingenious, and will evidently answer the purpose intended; it is particularly calculated for large establishments.

13. For an improvement in the machinery for *Spinning Cotton, Silk, Flax*, and other materials; George Addison, and Samuel H. Stevens, New York, October 10.

The end proposed to be accomplished by this invention is similar to that which Mr. John Thorp, of Providence, and some others, claim to have attained by other means. Those intimate with the subject will recollect the plans of Mr. Thorp, for dispensing with the common flyers, as described in our last volume, and partially also in this number. The present plan bears a nearer resemblance to the "Ring groove spinner" than to either of the others.

Circular openings are cut out in the wave rail, around the spindles. Metallic rings, of a suitable size, are fixed above, or within, these openings. These rings are made very true, and smooth, and in such a form that a light piece of metal may clip round their edges, by means of small projection, or wires, attached to them for that purpose, this latter piece is called a *traveller*; it passes freely round the ring, being carried by the thread as it is spun; there is an opening, or eye, in the traveller, through which the thread passes.

The specification notices the various plans which have been heretofore pursued, for the purpose of showing that they differ, specifically, from that now patented. There is no particular claim, as nothing is described but the part which is accounted new. It is stated that "the general resulting benefit of this improvement is of great importance in the art of spinning. The operative parts of spinning machinery, viz. the flyer, and the bobbin, and spindle, by means of this invention, may be so much reduced in size and weight, that spinning machines having this improvement need not be so massive, or heavy, or strong, or occupy so much room as heretofore. Buildings of less solidity and extent may take the place of the massive and

expensive structures heretofore deemed necessary, and the power used to drive a thousand spindles on the old construction of machinery, will drive twice as many on this construction."

14. For making *Bit-stocks of Composition*; Augustus Phelps, Marlborough, Hartford county, Connecticut, October 10.

The following is the specification:

"The bit-stock is composed of cast-iron and brass. The main, or lower part, is of cast-iron, the head and neck, or top part, of brass. The principle and operation of said bit-stock are the same as those that are now in general use."

We have known bit-stock of *cast-iron*, with heads of wood, sheet-iron, brass, or copper, for more than thirty years. Many hundred of them, made in imitation of the celebrated Scotch stocks, have been imported from England, and the purchaser has frequently found, to his cost, that his iron stock has broken by a fall from his bench, and that it was not in the power of the smith to weld it.

We can assure the *inventors*, or *discoverers*, of cast-iron hammers, tire, horse shoes, stocks, &c. &c., that they have been so completely forestalled by the English in the art of casting all those articles which ought to be made of wrought iron, as scarcely to leave room for any *new discovery* upon the subject.

15. For a *Machine for Making Shingles*; Joel Barnes, Cornwall, Litchfield county, Connecticut, October 10.

A wheel of wood, about six feet in diameter, is made to revolve, vertically, upon gudgeons; a knife, or cutter, is fixed upon one face of this wheel, projecting from it the thickness of a shingle. The bolt, or block, to be cut, is placed upon a proper bearing attached to the frame, and is forced by hand, against the face of the wheel when in motion; the wheel is to revolve about sixty times in a minute. There is, of course, an excavation in the wheel, under and behind the knife, for the escape of the rived pieces. This constitutes the whole of the machine, and as there is no claim to any particular part, we are to consider *the whole* as new.

16. For a *Rolling Valve* for supplying the boilers of steam engines with water; Elam Young, Tate township, Clermont county, Ohio, October 10.

The rolling valve is in form like the key, or plug, of a common cock, fitted into a socket, and standing horizontally in a reservoir of water, from which the boiler is to be supplied.

The valve, or key, has two chambers formed in it, at 90 degrees apart; these are filled with water alternately, through perforations in the socket, the valve is worked backwards and forwards by means of a pitman from a crank, which carries the water down to an opening in the lower part of the socket, communicating with the boiler. It is intended that the valve should be self-regulating, by causing

the chambers to contain the proper quantity of water for the generation of steam.

The claim is, "the supplying the boilers and generators of steam engines by means of a rolling valve."

The great objection to valves of this description is their wear; the four-way cork, and rotary, or vibrating valves, acting upon this principle, are necessarily subject to this objection, but for which, a valve such as that now described, would be preferable to a forcing pump. The idea of such a valve is not new; we cannot immediately turn to any printed evidence of this, but it has been familiar, and matter of frequent conversation with us for years.

17. For an improved *Washer and Churner*; George B. Gibbs, Pike, Bradford county, Pennsylvania, October 10.

Mr. Gibbs thus describes his washer and churner, "the form is, or resembling, the frustrum of a pyramid; the diameter of the base from two to four feet, that of the top from six to twenty inches, through which passes a pin, or fulcrum, upon which a lever, from three to ten feet, swings, with or without a joint, cog, or wheel, to which is attached an open paddle, with two posts, which are connected by two or more slats, which is moved within the cylindrical box by the above mentioned lever."

GEORGE B. GIBBS.

If the above description appears to be obscure, we can assure our readers that the drawings which accompany it possess the same quality in an equal degree; it is much to be doubted, however, whether any thing be lost by this defection, as we think that most house-keepers employ a better washer, and those who keep cows a better churner, than most of those which are patented, although they stand upon *two feet*, and have, therefore, a lesser base than that of Mr. Gibbs.

18. For a *Leather Tree-saddle*; Matthias Holdeman, Trapp, Montgomery county, Pennsylvania, October 10.

As the title indicates, this patent is taken for making a saddle-tree of leather, instead of wood. The mode of cutting and joining the pieces so as to obtain the proper form, is described in the specification; when made, the whole is to be well sized, or stiffened, with glue. There is no particular claim, the object being to secure the right to make saddles with leather trees.

19. For an improvement in the common *Saw Setter*; Ira Hatch, Westford, Chittenden county, Vermont, October 12.

This is a new edition of the saw-set, but we cannot say an improved one, as it is precisely like such as have been before patented. The set is made in the common way; it has upon its handle, or shank, a sliding piece, tightened by a screw, with a gauge screw tapped into it, which, when the proper set has been given to the tooth, will bear

against the side of the saw. What is claimed as *new*, is, "the gauge to regulate the bevil required to the teeth in setting the saw."

There are some half dozen patent saw sets operating upon this principle, but we believe that workmen in general prefer to set their saws by the old saw set, or with a punch. Were saws soft, or perfectly equal in their texture from end to end, these patent saw sets would answer a good purpose; but this, according to our experience, is rarely the case, and consequently the eye and the hand become the best guides.

20. For *Raising Boats from one Level to another, on Canals*, by means of inclined planes; Ephraim Morris, Bloomfield, Sussex county, New Jersey, October 13.

The design is to draw a cradle, or car, containing a boat, up an inclined plane, by the power of water wheels. As this is not new, the patent is taken for several improvements which are specified, but which cannot well be described in words. Hitherto the inclined planes which have been constructed have disappointed the anticipations of their inventors; and, although we have often been told of perfect success in newly constructed works of this kind, the searching operator, time, has pointed out great defects, and has still left a good inclined plane, a desideratum. We are not aware that the plan now proposed offers any striking novelty, but should it remove the difficulties experienced in existing structures, its merits would be of a high order.

21. For an improvement in the mode of *Hanging and Straining Saws*; Levi Chapin, Walpole, Cheshire county, New Hampshire, October 13.

The plan proposed is intended to render the ordinary saw frame unnecessary in the straining of mill saws. Two wheels, or drums, are placed one over the other, each working upon gudgeons. The boxes of the upper gudgeons are to be stationary, those of the lower ones are to work in a slat, so that by means of a wedge, or a lever and weights, the drum may be forced down for the purpose of straining the saws. A band, or chain, passes over the upper drum, and another under the lower drum; to the ends of these bands, or chains, saws are to be fixed by stirrups; the two chains, and two saws, when thus united, form a continued band round the two drums, or wheels; an alternating, crank motion, communicated to one of the drums, will cause the saws alternately to ascend and descend. The novelty, and improvement claimed "consists in hanging two saws, without the use of saw frames and gates, and wholly relieving the crank, or power, necessary to operate saws, from the heft or burthen of any apparatus necessary to hang or strain saws, leaving all the power to operate the saws in the work. The principle is intended to embrace all the various forms in which sawing is required, whether by means of wheels, cylinders, or drums, or parts of either, or by use of chains,

ropes, belts, or springs, or by forcing the strain by the power of the wedge, lever, or screw, of whatsoever materials they may be formed."

The above claim appears to us to be much too broad and general. The particular mode described by the patentee is probably new, but the idea of a saw acting as a band, strained over drums, is old. By turning to the article *saw*, in Rees' Cyclopædia, it will be seen that a patent was obtained in England, many years ago, for a saw forming a continued band, working over two wheels, or drums, not by a vibratory, but by a continued motion.

22. For a machine for *Scalding and Napping Hats*; Daniel Baldwin, Ithaca, Tompkins county, New York, October 15.

The machine described is a sort of box, to be placed over a planking kettle, or large boiler. At the top of the box is a pulley, worked by a rope, for the purpose of letting from ten to fifty hats at a time descend into the heated liquid, or drawing them up at pleasure. There, of course, is no bottom to the box, and the hats are contained in a cloth suitably fixed for the purpose, and which, with other parts, is particularly described in the specification.

23. For a *Feather Cleaning Machine*; Charles Toupet, New York, October 15.

This is a sort of bolting machine, in which the feathers are to be stirred and beaten about, and the dust separated from them. A long trough is made, the upper part of which is of leather, formed and supported like a wagon tilt; at the lower part is a drawer, covered with wire grating, to receive the dust. A frame, like that of a bolter without its cloth, is made to revolve within the trough by means of a crank; from this frame small pieces of wood, or sole leather, project, which are to act upon the feathers. The machine is placed in an inclined position; the feathers are put in through a door at the upper end, and when they arrive at the lower, are said to be "perfectly bright, clean, and free from all impurities." There is no claim, the whole machine, therefore, is patented.

24. For a churn called a *Box Churn*; Thomas and Lansing Morrison, Groton, Tompkins county, New York, October 16.

A box which may be 18 inches long, and 14 wide, or of any other length, width, and depth, is to have a top, bottom, sides, and ends, all put together so as to hold milk or cream; gudgeons are to be fixed on the sides of said box, to one of which a crank must be attached to turn it. The lid must fit so well that the contents may not leak out; a faucet, or cock, is placed to allow the butter milk to run off, and if it will not do so when the box stands horizontally, it may, by means of the crank, be held in a sloping direction, "and the butter will remain in a ball, or balls, in the churn." So endeth the description, and, very wisely, nothing is claimed.

25. For a *Harpoon* of cast-iron and wrought steel, with a wrought iron shaft; Jonathan Sizer, 2nd, New London, Connecticut, October 16.

The following is the specification:—

“The head to be of cast-iron, zinc and tin, lead, or copper, so as to give the dart, or harpoon, sufficient strength. The edges, knife, or cutting part, to be either of wrought iron, or cast-iron, wrought steel, or cast steel; to be cast or rivetted in the head. The shank, or shaft, to be of wrought iron, wrought steel, or copper. The shaft, or shank, to be cast into, or firmly rivetted, on the head of the harpoon, and fixed therein strong and solid.”

Of what materials our whalers will hereafter make their harpoons, we wot not, as nearly all, excepting the precious metals, are now patented. It is not the form of this harpoon that is new, but the *old* materials. We may expect to hear of a jubilee among the finny tribe, when they learn that they are not to be harpooned, either with iron, or steel, wrought or cast, zinc, tin, lead, or copper, excepting by permission of J. S. 2nd.

26. For an improved mode of *Tightening Doors and Windows*; Stephen Hayward, Plainfield, Hampshire county, Massachusetts, October 17.

A fender is to be fixed by hinges at the bottom of outer doors; on the door sill, near the hinge side, a piece of iron is fixed to raise the fender as the door opens; strips are to be fixed in the rebate, or groove, of doors and windows, and to be borne up against their edges by spiral or other springs. We do not think it worth while to be more particular in describing this contrivance, and shall, therefore, only add the claim of the patentee.

“What I claim as new, and as my own invention, is the manner of raising and confining down the fender at the bottom of the door; also the pieces in the casing, borne by springs against the face of the door; also bearing the slides in windows against the sash, to keep the sash tight, and hold it when raised.

27. For a *Churn*; James C. Barrett, Collins, Erie county, New York, October 19.

This is the most formidable churn which, to the best of our recollection, we have ever encountered. A very strong frame is made, upon which there are to be raised two fender posts, from 4 to 5 feet high, from 2 to 3 feet wide, and from 2 to 3 inches thick, for a *common churn*, but larger for those which are of extraordinary size. Within these fender posts are three cog wheels of 2 feet 6 inches, and 2 feet diameter respectively, and four pinions of 8 inches diameter each. The first pinion is to be acted upon by the moving power, the last is to give motion to the dashers of a churn, the intervening wheels and pinions gearing into each other, *secundum artem*.

The moving power is a heavy vertical rack, working up and down in a groove, and when in gear, taking into the first, or upper pinion.

"This vertical rack is about 10 feet long, and from 2 to 6 inches square, more or less, as may be required; and the teeth from top to bottom of said rack may be made of cast or wrought iron, or may be wooden pins, and be so adapted as to work into the wheels and pinions." This rack is to be wound up by a crank, and by its weight is to set the whole train at work, and of consequence churn the butter at the end of it.

"What I claim is the peculiar arrangement of the apparatus above described, with the heavy descending rack employed as the moving power."

28. For an improvement in the *Knob Lock*; James Patterson, Birmingham, St. Clair township, Alleghany county, Pennsylvania, October 19.

The latch, or spring bolt, of this lock, is forced forward by a spiral spring instead of the kind of spring ordinarily employed; this is all that is claimed. In spring catches for round tea tables and candle stands, such springs have been used upon the tail of the bolt, for forty years at least, nor are they new in locks; they have before been patented in the United States, and it is to be doubted whether the claim was then good.

29. For an improvement in the *Application of Hydraulic Power*; Zebulon and Austin Parker, Coshocton county, Ohio, October 19.

The patentees claim to have invented improved methods of using water, by "combining percussion with reaction, applied and exemplified in,

"1st. A compound vertical percussion and reaction water wheel for saw mills and other purposes, with the method of applying the water on the same.

"2nd. An improved horizontal reaction water wheel, with the method of combining percussion with reaction in it.

"3d. A method of combining percussion with reaction on common reaction wheels, or those already in use."

After describing the particular manner in which they construct their wheels, the patentees say, "the parts of the above described machinery claimed as original, are as follows: 1st. The compound vertical percussion and reaction wheel for saw mills and other purposes, with two, four, six, or more wheels on one horizontal shaft. The concentric cylinders enclosing the shaft, with the manner of supporting them. The spouts which conduct the water into the wheels, from the penstock, with their spiral terminations between the cylinders. 2nd. The improvement in the reaction wheel by making the buckets as thin at both ends as they can safely be made, and the rim no wider than sufficient to cover them. The inner concentric cylinder. The spout that directs the water into the wheel; and the spiral termination of the spout between the cylinders. 3d.

The rim and blocks, or planks, that form the apertures into the wheel, and the manner of forming the apertures. The conical covering on the blocks, with the cylinder, or box, in which the shaft runs; and the hollow, or box gate, in any form, either cylindrical, square, rectangular, or irregular."

It will be seen from the foregoing, that there is considerable complexity in the apparatus patented; and it may be collected, that the plan proposed consists, mainly, of enclosed wheels, with curved buckets, and certain spiral convolutions in the openings through which the water is to act. It is in fact a modification of the principles of Barker's and the tub wheel. The patentees state that they have, with great advantage, put their plan into operation. We apprehend that if this be the fact, the mills with which they have made a comparison are not such as are constructed upon the best principles for economizing water. The ordinary tub wheel is recommended by its simplicity, where water is abundant, but where it is necessary to save water, and it can be applied to an overshot, pitch-back, or breast wheel, we despair of seeing it more efficiently employed; these, it is true, may be, and generally are, badly constructed, or improperly geared; but where their velocity is duly regulated, their buckets properly formed, and the water delivered upon them at as great a height as possible, its whole effect, which is due to its gravity, will be obtained. In practice Barker's mill has been abandoned.

30. For an improvement in the manner of *Inking Types, Stereotype Plates, Wood Cuts, &c.*, by means of an apparatus denominated the "Gravitating Inking Roller Apparatus;" William J. Stone, Washington, D. C. October 20.

Some account of this invention will be found among the specifications in the present number; we expect, shortly, to give the whole specification, with engravings.

31. For a *Floating Saw Mill*; John C. Ely, New York, October 21.

"Construct a saw mill in the most approved manner; place it on a scow, boat, or any other floating vessel, of sufficient strength and buoyancy. Make two paddle wheels, connected by an axle, one on each side of the boat; put a steam engine on board this vessel; let it be so geared as to move the paddle wheels, as well as to drive the saw mill.

"It of course saves all the expenses of erecting dams, and conveying the timber to saw mills, as the floating saw mill can be moved to the most convenient places on the river for business."

The claim is to "a floating saw mill, to be propelled by steam or animal power, and moved from place to place where timber is found."

We see so many objections to this mill, that we cannot attempt an inquiry into its merits without more time and space than we can now afford.

32. For a *Washing Machine*; Henry Shiveley, Robert S. McEuen, and John Lindsey, Fredericksburg, Wayne county, Ohio, October 21.

To arrive at once at the merits of this machine, we shall leap over the *descriptive* part, and attend to the *application*, which is in these words; "before commencing to wash, the *operator*, with the fluted roller, is thrown up out of the box, the clothes thrown in, and spread on the fluted bottom, and the fluted roller brought down upon them by the operator, and the operation of washing commences by moving the fluted roller backwards and forwards over the clothes by means of the operator." The *operator* is the name given to the part which is to be pushed backwards and forwards.

33. For a *Plough*; Reuben Reeder and Stephen D. Ashley, Hamilton county, Ohio, October 21.

Every part of this plough is to be made of iron, with the exception of the handles, and these may be so made, if thought proper; its general form differs but little from that of other ploughs, and in what its particular merit lies we are not told, and cannot tell, as there is no claim.

34. For a *Plough*; Timothy Miller, Pittsburg, Pennsylvania, October 23.

The improvements claimed are to "the share, cutters or coulter, and mould board, being made of cast or wrought iron, or part of wood and part iron, connectively forming one entire unbroken surface, so that the edge of the sod, when cut, will rise in a concave, or hollow, formed by the consolidation of the cutters and mould board, on an inclined plane, continually increasing in elevation, until it shall be elevated to its greatest height, near the upper edge and in the centre of the mould board from the centre of the beam to the extreme hinder point of the mould board."

"There being a first and second cutter, both having circular edges, the second is continued from the first one to near the under side of the beam, and inclined to the furrow side, so that the centre of the edge is perpendicular with that side of the beam. And the value of this invention consists in this, that whatever may escape the first cutter, will be cut by this second one, and that grass, or weeds, cannot accumulate under the beam, which, if they are not carried off by the sod, will immediately fall off on the land side, and clear the plough."

The foregoing is nearly the whole of the specification, with the exception of the drawing and references, which describe particularly the form, dimensions, and connexion, of the respective parts.

35. For a *Press for Pressing Cheese*; Richard McOmber, Galway, Saratoga county, New York, October 27.

The press described is a compound lever press, the first lever acts immediately on the cheese, whilst it is itself acted upon by the se-

cond lever. At the connexion between the two levers, there is a spiral spring made of No. 4 wire, which is to continue to act by its elasticity, after the second lever has been forced down and confined.

Neither the spring or any other part is claimed, and we are left, therefore, to the conclusion, that the compound lever is new, as well as all the other parts described. The only novelty we see is the spring, and why a weight upon the end of the second lever would not produce all the advantage expected from the spring, we cannot divine.

36. For a method of *Reducing Friction in Rail-road Carriages*; Hugh Finlay, Baltimore, Maryland, October 27.

This is a new form of friction saving machinery. The main axle and wheels of the carriage are to be made as usual; two strong rings, the insides of which are rounding, are suspended, one near each end of the axle, within the wheels. Two pulleys, or wheels, having their edges grooved to fit the insides of the rings, are connected together by an axle, and are then placed within the rings, so as to hang below the main axle. The load is to be suspended upon the axle which connects the pulleys.

In what respect this mode of reducing friction is superior to that of Howard, Winans, and others, we are not informed, and according to our judgment it would be difficult to discover. Several objections to the plan forcibly present themselves, but we cannot now stop to discuss them.

37. For an improved *Perambulator, for Ascertaining the Distance Travelled* in a Chair or other Carriage; Anthony Gifford, Westport, Bristol county, Massachusetts, October 27.

A small brass box contains the wheels and principal part of the machinery. This is so fixed, that a lever, projecting from it, is acted upon by a steel cam, screwed upon the inner end of the hub, or nave, of one of the wheels. The lever, cam, and connecting arms, are particularly described and claimed.

Several similar machines have been constructed and used, some of which have been acted upon by a cam on the nave, in a way very similar to the present; it may, therefore, be doubted whether the parts claimed possess the requisite novelty.

38. For an improvement in the construction of *Trusses for Reducible Hernia*; Amos G. Hall, Surgeon, New York, October 28.

The petition sets forth that three successive patents have been previously taken for the same invention; the first dated 17th July, 1817, the second, 27th February, 1823, and the third, 19th August, 1824, "all of which have been found defective, and the two former have been cancelled;" and prays that that of 1824 may also be cancelled and a new one granted for the remainder of the term, 14 years, from the date of the first patent.

Hull's truss is too well known to require a description here; the claim of the patentee has already been investigated in court, and we believe is, in some way, still a matter of litigation; under these circumstances we should deem it improper to make a comparison of, and give our views respecting the four respective specifications, or descriptions, of this instrument which have been furnished. It is, probably, to meet some legal question that this last patent has been obtained, which will expire in the year 1831.

39. For an improved *Cooking Grate*; Thomas Vinton, Philadelphia, Pennsylvania, October 29.

The drawing of this grate is in the hands of the engraver, for the purpose of accompanying the specification, which will hereafter be published.

Although this invention is of a very recent date, we have received assurances from persons of judgment in Philadelphia, who have it in use, that its operation is perfectly satisfactory. The grate is to be placed in a common kitchen fire-place, and it may advantageously be employed, at the same time, to bake, roast, and boil, all of which it effects by means of an open fire, in a grate of the usual construction.

40. For an improvement in *Pumps*; John P. Bell, New York, October 31.

Had we not been informed that this is an improvement, we should really have concluded that the contrivance was intended, like a roundabout walk, merely for exercise, as it is admirably calculated to increase friction, and waste power.

There are two pumps, the piston rods of which are worked by means of two eccentric circular wheels, the centre of motion of which throws them out about 10 inches each way. The peripheries of these eccentrics work between two bars, or guides, standing at right angles across each of the piston rods, at a distance from each other equal to the diameter of the eccentrics.

There are three cog wheels, two of them about 20, and the other about 10 inches diameter. The two first gear into each other, their gudgeons being on the same horizontal bar; upon the faces of these wheels the eccentrics which work the piston rods are fixed. The driving wheel is placed above, and may be made to gear into either of the others at pleasure.

The claim is to "the mode of using eccentric wheels, when applied to pumps for raising water, as above described."

41. For an improvement in *the Art of Milling*; Jesse Reeder, Lebanon, Warren county, Ohio, October 31.

An iron mill is to be cast, like the common mill used for coffee, and many other purposes. The patentee "claims an improvement in the art of grinding; as his mill is found to make a more round, even, and lively meal, than is made on the common mill stones; but especially does he claim the invention of picking, cutting with a cold chisel, or

sharpening and dressing the above described, and all metal mills used for grinding grain."

The main furrows are to be formed in casting, or they may be cut in afterwards; these furrows are to be cut over their whole surface, with a sharp chisel, or pick, so as to be covered with teeth in the form of a float, or single cut file; and when dull, are to be sharpened in the same way.

42. For an improvement in *Making Boots*; Alden Burdick, Carroll, Chautauque county, New York, October 31.

This improvement consists of machinery which is intended to stretch the leather for boots upon the crimping board. Three pincers are placed on each side of the board; and these are attached by bands, or cords, to rollers turned by a crank, and held in their places by a ratchet wheel. The belts are attached to one handle of the pincers, and pass through a mortise in the other, by which they are made to grasp the leather firmly.

DESCRIPTIONS OF AMERICAN PATENTS. †

A short description of an improved Inking Apparatus, to be used with the ordinary Screw, or Lever, Press. Patented by W. J. STONE, of Washington, in the District of Columbia, October 16, 1829.

THE inking apparatus for which Mr. Stone has obtained a patent is to be appended to the ordinary printing press, and to obviate the necessity of employing a person to ink the form. As we shall, probably, at an early day, publish the specification, with drawings, a brief notice of the invention is all that we now propose to give.

The roller by which the types are to be inked, is to be made of the usual composition, or an improved roller is to be formed by interposing a layer of some substance impervious to oil, between the blankets which give elasticity to the roller, and the leather with which it is covered. The ink is to be contained in a trough and supplied to the elastic roller by one of iron, in the same way in which it is usually supplied in power presses. The mode of spreading the ink, so as to equalise it is new. This is effected by two rollers working against the inking roller, these are called equalising rollers. They have a fillet, or thread, extending from end to end, like a square threaded screw, and operating as right and left handed screws, force the ink in reversed directions.

The inking is effected by a motion communicated to the apparatus by the traversing motion of the bed and form, and takes place whilst the printed sheet is removed and replaced. A rack, or other similar contrivance is placed under the bed, and geared to the inking apparatus. The bed is allowed to acquire a certain degree of momentum before it engages the rack with the wheel, or pinion, so that but little extra resistance is felt by the pressman. There is an iron frame, or rail-way, which works upon pivots, so as to be inclined either towards,

or from the form to be inked. Upon this rail-way, an iron roller runs backwards and forwards, according to the inclination of the frame which guides it. From this iron roller, arms extend to the inking roller, which is made to traverse over the form by the gravity of the iron roller. The mode of tilting the frame, or rail-way, will be described hereafter; it may be effected in various ways, and is not, therefore, intended to be confined to the one adopted.

The points claimed, are, the carrying the inking roller forwards and backwards over the form by the descent of a gravitating body, like the iron roller described, by reversing the inclination of the bars upon which it runs. The communication of motion from the bed to the inking roller, either by a rack, or other gearing. The allowing the bed to acquire momentum before it acts upon the rollers. The use of a stratum, or layer, impervious to oil, as above noticed; and to the mode of equalising the ink.

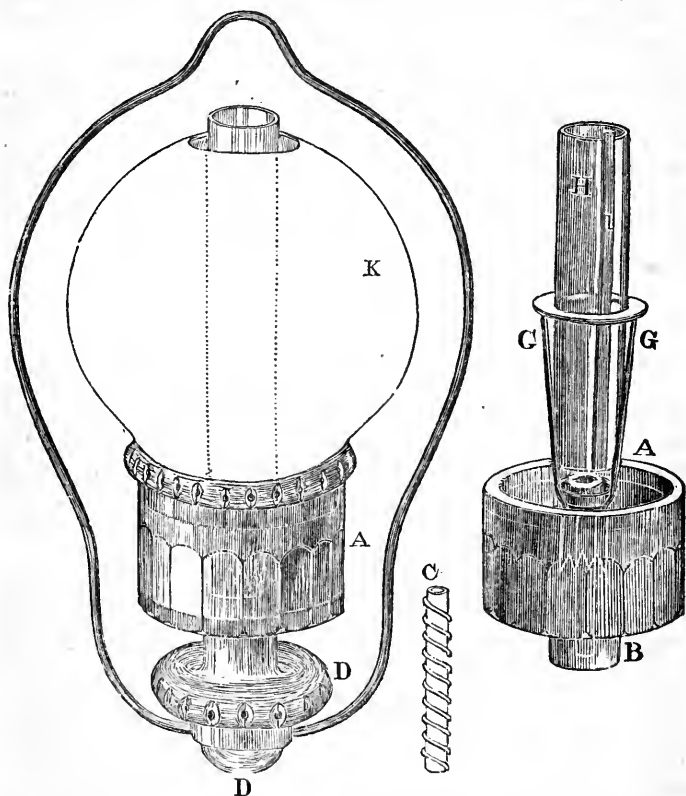
We have seen the apparatus in action, and the only defect which we perceived was the result of bad workmanship, and the almost unavoidable imperfection of a first attempt. There is not, in Washington, any establishment where instruments of this description can be readily and correctly made.

Description of an improved Lamp, for which a patent was obtained by
ISAIAH JENNINGS, of New York, September 10, 1829.

WE have already described two improvements in lamps for which patents have issued to Mr. Jennings, but improvements in general are progressive, and it consequently rarely happens that an invention good in principle, is at once presented perfect in its details; this truth has been exemplified in the successive improvements made by Mr. Jennings, in the lamp before us.

The accompanying drawing represents a lamp intended to be suspended in a hall, or elsewhere; it may, however, be fixed in any of the ways in which lamps are used. The oil vessel, or reservoir, A, is of glass; in the specimen from which the drawing was taken, this vessel was about four inches in diameter, and two and a half in height; it has a projecting piece, or neck, B, on the bottom, to fit into a corresponding socket, in the glass step D, D, which forms the bottom of the lamp, and serves to sustain it in the brass socket and wire by which it is suspended. The neck, B, is perforated, and receives the brass tube, C, around which the cotton wick is to be placed; the spiral threads which surround this tube, serve to raise the wick when necessary; it is fixed in the neck of the reservoir by means of a cork, perforated to receive it. The draft of air through this tube to supply the inside of the wick, is admitted through the openings cut in the glass step, as seen in the drawing. The brass tube is about half an inch in diameter, and three inches in length, its upper end is even with the top of the reservoir. The oil which may drip from this tube is collected in the lower part of the step, from which it may be cleaned when necessary.

The wick, when placed on the tube C, does not reach to the top of it by about half an inch, as this wick is not intended to burn, but merely to supply oil, by capillary attraction, to a supplementary wick, which is to be burnt, and renewed when wanted. This wick may be made by winding a strip of coarse cotton, of about half an inch in width, around the finger, and tacking it so as to form a ferule, or wick, of the thickness required; the intensity of the light depending, principally, upon the thickness of this ferule. A second tube of brass, or copper, is made to slide over the wick, but not to compress it;



this second tube is seen at the bottom of the burner; the upper part, which receives the ferule of cotton, is larger than it is below, to admit of a greater thickness of wick. Three wires, G, G, are soldered on the outside of this last tube, and to a metallic ring above, to receive the glass chimney, or burner, H. It is proposed sometimes to make these burners of mica (usually called isinglass) by bending it round and uniting the edges by a grooved strip of thin metal, as shown at I. By turning the outer metallic tube, the wick upon the spiral part is raised, and pushes up the supplementary wick, which, however, is

not frequently necessary. The outer ferule reaches to, and rests upon, the bottom of the reservoir, and is perforated with holes to admit the oil freely to the wick.

A glass globe, or vase, K, surrounds the burner, and fits by a lower flanch, or rim, into the reservoir, the chimney, or burner, passing through an opening in its top. The lower part of the globe, or vase, is perforated, as represented, to supply air to the outside of the wick.

We have one of these lamps in use; it is elegant in its appearance, and perfect in its operation; it is generally employed as an entry lamp, but when extra light is required, by using the supplementary wick of an increased thickness, the illumination is really splendid, being equal to that of several ordinary Argand lamps, and strongly resembling that from gas. The quantity of oil consumed, in this case, is, of course, much increased, but is less than was anticipated. When used with a thinner wick, as an entry lamp, the supply of oil in the reservoir will last for a week.

*The original description of MR. JOHN THORP'S improvements in Spinning, by substituting a Ring, or Can, for the ordinary Flyer. Received at the United States Patent Office, March 31st, 1828.**

*State of Rhode Island, Providence county,
Smithfield, March 21, 1828.*

To the Hon. the Secretary of State of the United States.

SIR,—I take the liberty to forward to you the following account of some improvements, to be lodged in the patent office as a safeguard, until I can forward the other requisites for obtaining a patent.

The subscriber's improvements in spinning are as follows, viz. *a ring* which encompasses the bobbin, answers the purpose of a flyer, and around the surface of this the yarn revolves, being drawn by the bobbin as it twists and receives it. Said ring is used instead of a flyer, like the arms of which, it serves to keep the yarn at a proper distance from the bobbin, and also to direct and distribute it thereupon; said ring is kept in its proper place by a *circular plate*, which also encompasses the bobbin, and has in it a groove formed by one or more circular lips or margins projecting therefrom. Said plate is confined to the bobbin rail; and in said groove the ring is loosely placed, allowing the yarn to revolve around its surface, or when a greater friction is required, a notch may be made in the ring, in which the yarn can lodge, and thereby dragging the ring and causing it to revolve in said groove. The said plate is open at one side, giving the yarn a free passage to the ring. The same use and purpose of the above ring can be performed *by a cup, or can*, placed on the end or top of a still spindle, the rim or edge answering the purpose of said ring. The object of the above described improvements

* At the request of Mr. Thorp, we insert the above letter to the secretary of state, for the purpose of making known the date of his first application.

42 *Comparison of PERKINS', and the old Paddle Wheel.*

is to dispense with the flyer, and thereby with a great friction which the arms of the flyer will always create, also to increase the length of the bobbins, so that a greater quantity of yarn may be spun before they require shifting; and furthermore, to give a greater speed to the spindle than the arms of the flyer will allow of, and also to enable manufacturers to spin slack twisted filling on to a bobbin suitable for the shuttle, &c. The above specified improvements I claim as my invention, verily believing myself to be the original inventor and discoverer of the same.

Yours, &c.

JOHN THORP.

*Observations on Paddle Wheels now used in Propelling Steam Vessels, and on those recently invented and patented by JACOB PERKINS, Esq.**

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

SINCE the application of steam to the purposes of navigation, no description of machinery, except the steam engine itself, has occupied so generally the time and attention of mechanics as the paddle wheel. Inventions endless in variety have been patented for propelling steam vessels; till lately, however, none have been found so efficient, durable, and economical, as the common wheel, notwithstanding its waste of power is very considerable.

When the dip of the common wheel is not more than $\frac{1}{10}$ th of its diameter, the waste is erroneously supposed to be inconsiderable; but when it exceeds that proportion, the loss of power is confessedly in geometrical progression; it being found that if the wheel be immersed to half its diameter, the strain on the engine becomes so great as to leave very little of its force applicable to the propulsion of the boat.

Of course, sea going Steamers are, from the irregularity of the ocean's surface, more exposed to this injurious influence than vessels navigating rivers or quiet waters, where the dip of the wheel can be regulated.

It is obvious that the common paddle, when at the lowest dip, where it should have the greatest power, moves in water already disturbed by the preceding paddle, and it is evident that after the paddle has passed the lowest dip, it is not promoting the progress of the vessel, as it would do if it were acting in undisturbed water.

To obviate some of the difficulties above stated, an eminent individual, Mr. Oldham, of Dublin, has, in common with many others, taken great pains and incurred considerable expense. He constructed a wheel, the paddles of which enter the water edgeways, and by

* This communication was written in London, by a gentleman who witnessed the experiments of which he speaks, and was forwarded for publication in this Journal, by a person recently returned from England, who has himself examined the apparatus, and is perfectly satisfied of the correctness of the facts detailed.

machinery attached to them, gradually change their position, until, on their successively arriving at the lowest extremity of the wheel's rotation, they present a face at right angles with the keel; and then gradually revolving, leave the water edgeways. But the complexity, increased friction, liability to derangement, weight and expense of this wheel, were found more than to counterbalance its theoretical superiority.

Simplicity, durability, lightness, and cheapness, are requisites not to be dispensed with in the construction of paddle wheels. If with these essentials a wheel can be constructed to work with undiminished action at a dip ordinarily of $\frac{1}{3}$, and occasionally of one-half its diameter, without incurring a greater consumption of steam power than attends the common wheel when used in still waters, then a remedy will have been found for the great loss now experienced in sea going vessels.

Such a wheel has lately been invented by Mr. Jacob Perkins.

Those who have witnessed the Chinese method of sculling, must be strongly impressed with the superiority of that over the European application of the oar. The action of Mr. Perkins' wheel is not unlike that of the Chinese scull; in fact, the only difference is, that the motion of the scull is reciprocating, that of the paddle wheel in question, rotary; the rotary motion being clearly preferable, inasmuch as the frequent change of motion in the scull is so much waste of power.

Comparative experiments with the common and with the newly invented wheel alternately used in the same boat, have shown, that even at a shallow dip, the most appropriate to the common wheel, there is a very important gain with the wheel of Perkins. But when the wheels are each of them immersed to $\frac{1}{3}$ of their diameter, (perhaps an average dip for sea going vessels,) the advantage attending this newly invented wheel is scarcely credible.

The experiments alluded to were made in the presence of an eminent engineer, and were as follows: a boat was propelled by a weight falling a certain distance, attached to a line turning an endless band, running over a pulley fixed on the shaft connecting the paddle wheels. Two sets of paddle wheels, one on the common, the other on Perkins' principle, were put in succession into the boat. The two sets of wheels were nearly of the same weight, any little advantage in this respect being in favour of the common wheel. The boat moved round a basin of water measuring within 36 feet.

Old Paddles.

1st Experiment,	6 Rotations,	216 feet	in 3'.40"
2nd do.	$5\frac{3}{4}$ do.	207	3. 40
	<hr/>	<hr/>	<hr/>
	$11\frac{3}{4}$	423	7. 20

New Paddles.

1st Experiment,	$15\frac{3}{4}$ Rotations,	567 feet	in 8'.16"
2nd do.	15 do.	540	8. 25
	<hr/>	<hr/>	<hr/>
	$30\frac{3}{4}$	1107	16. 41

In these experiments, the weight supplied the force of steam. They show that the same quantity of steam will propel a boat with Perkins' paddles 1107 feet in 16'. 41'', which with the common paddles moved only 423 feet in 7'. 20''. The saving in fuel, therefore, appears to be upwards of 3 in 5; $211\frac{1}{2}$ being the moiety of 423, and 211 and a fraction being the 5th of 1107. Over and above the saving in fuel, these experiments show an increased speed of about 15 per cent., or a saving in time of 9 minutes in an hour. For 16'. 41'' : 1107 :: 7'. 20'' = 486, a gain of 63 feet on 423.

Facts are stubborn things, opposed as they may be to the theories of men of acknowledged ability. It has been asserted by certain eminent engineers, that the common wheel admits of but little improvement. If it cannot be demonstrated that much power is lost by the common wheel, then would those engineers be borne out in their dictum. But recent experiments in England and America prove the loss of power with the common wheel to be very much greater than had hitherto been imagined: If the loss were trifling, could a single horse on a towing path do the work of a six horse engine in the boat? Could 2 horses attached to the hawser of a boat moved by a 25 horse power engine, neutralize the power of the engine, stay the progress of the boat, and occasionally give her stern way? These facts, however, are well authenticated.

Engineers, who believe in the perfection of propelling machinery on the old plan, exultingly reply to these facts by making abstract inquiries; such as, whether a vessel can move as fast as the periphery of the wheel by which she is propelled? Whether, if a boat move $\frac{1}{2}$ as fast as the periphery of the wheel, it is not considered fair speed? and then jump to the conclusion that the whole loss of power cannot exceed $\frac{1}{2}$, and that, allowing for friction, it is absurd to expect to save much of that small proportion by any improvement. That this conclusion is premature, the following remarks are intended to prove.

Let it be supposed that a paddle wheel can be made of such power and to have such hold on the water as to move only 100th part faster at its periphery than the vessel it propels. The difference in such case between the relative velocity of the wheel and the vessel would be as 99 to 100. It is true the magnitude of the wheel would require steam power in proportion, and then the remedy would be as bad as the disease, but the case is practicable. To suppose, therefore, that the loss of power is only as the relative movement of the wheel and of the boat, is as absurd as it would be to assert, that inasmuch as the carriage wheel and its body move with equal velocity, it matters not what load the carriage contains. In the one case the speed or draught of the horses must be increased, so in the other must the steam power.

We will consider the subject, however, in a more tangible shape. There are four kinds of water wheels, of which the undershot assimilates more to the paddle wheel than the others; and the undershot wheel, it is acknowledged, loses $\frac{2}{3}$ ds of its power, that is to say, if 3 lbs. of water fall 1 foot on an undershot wheel, it will not communicate impetus sufficient to raise more than 1 pound to the height

of the fall, Let us examine these data in three points of view with relation to the paddle wheel.

1st. The undershot wheel is propelled by water descending on it.

2ndly. The water so falling is so directed as to strike the float boards at right angles with their surface.

3dly. Although the power is communicated by water moving at a quicker rate than the wheel, yet so soon as it has communicated a portion of its impetus to the wheel, that quantity of water left on the float boards and hurried round with the wheel, is dead weight, and serves only to impede the wheel's velocity, and so to diminish its power.

In all these particulars, the disadvantages attending the common paddle wheel are greater than those above described.

1st. The water cannot descend upon a wheel revolving on a plane of water.

2ndly. The paddles do not strike the water at right angles with their surface; yet the impetus given by the first paddle is the principal power, inasmuch as it is exerted on undisturbed water, all the others moving in water previously disturbed.

3dly. The inert body of water between the paddles, carried round by the wheel, must be greater than that taken up by the undershot wheel. And above all, the backwater is far more considerable with the paddles than with the undershot wheel.

Now if the loss of power with the undershot wheel is allowed to be $\frac{2}{3}$ ds, and it has been demonstrated that the loss by the paddle wheel is greater than with the undershot, the result of the experiments herein stated will be the less difficult of belief, and efforts to improve the paddle wheel be less open to be characterized as visionary and unprofitable.

Mr. Perkins' improvements remedy, in a great degree, the losses of the common wheel, whether by indirect action or by backwater. The paddles are made to enter and leave the water edgeway; when at the lowest rotation of the wheel, their action is at right angles with the keel; each paddle enters into and moves in water undisturbed by any preceding paddle; and thus every paddle immersed is doing service, though in different degrees, at the same moment.

The new paddles show the greatest proportionate advantage when $\frac{1}{4}$ d and upwards of their diameter is immersed. This degree of immersion would ordinarily amount to from 7 to 8 feet, instead of 2, the advantageous dip for the common paddle. The resistance of water being so much greater at the depth of 8 feet than it is at 2, too much importance cannot be attached to this material distinction between the two modes of propelling—Perkins' paddle being made more in the shape of an oar blade than of a float board.

As Perkins' paddles do not strike the surface of the water with their flat sides on entering it, the constant tremulous motion experienced in steam boats will be obviated. So violent is the concussion in a heavy sea with the common paddle, or if the wheel be much immersed, that the destruction of the paddle, and even of the shaft, or parts of the connecting gear, are not unfrequent occurrences.

Some observations on the opinion that Friction upon Rail-roads is in proportion to the time. By MINUS WARD, Civil Engineer, Baltimore, Maryland.

IN a pamphlet published by the writer of this article, in April, 1827, upon the subject of the Baltimore and Ohio rail-road, an attempt was made to demonstrate that the notion advanced by some of the English engineers, viz. "that the friction upon rail-roads is in proportion to the time," was founded in error—that there was, consequently, no danger of a locomotive engine running off with an accelerated velocity. The arguments which were there used were thought sufficient to convince any one that the friction, although it is not increased in its tractional amount, by an increase of velocity, is, nevertheless, *in proportion to the distance*. But it appears, the opinion that the friction is as the time, is still entertained by some. It has even been publicly taught, since the publication referred to above, that the friction upon rail-roads is in proportion to the time; from which it would appear, that the question was still considered by the public a doubtful one.

As every hint upon a subject of so much importance may be thought interesting, we have thought proper to lay before the public some additional views of the subject, and endeavour to demonstrate the truth of the proposition here maintained without reference to the power of steam, that being a subject which few understand.

In the first place, we are all, it is believed, prepared to admit the correctness of the experiment made by Roberts, see "Operative Mechanic," page 668. But what is the inference to be drawn from that experiment? we contend that it proves nothing more than this, that the tractional resistance, or pressure, or energy, or tension, (by none of these terms is meant power) which friction opposes to any agent employed to overcome it, is not increased by an increase of velocity. But does this experiment prove that the *power* consumed in overcoming this constant resistance for a given space, is not in proportion to that space. It is believed it does not. To make our reasoning upon a subject of this kind clear and comprehensible, it is advisable that we should imitate the geometrician, and endeavour to define the meaning of the terms which we intend to make use of. What then shall we understand by the word friction; is it mere pressure? No. Is it mere velocity? No. All that we know about it is from its effects; we know from these, however, that it causes a resistance, let its definition be what it may. To what standard shall we compare it when we wish to measure its amount? we know of no standard to compare it to, except power, for unless motion is produced, friction is not overcome, and we are certain it requires power to overcome friction. But here again it is necessary to define what is to be understood by the word power (mechanical power of course.) Is it mere pressure? No. Is it mere velocity? No. Is it the product of the two? No, but it is measured by the product of the two. We know

nothing of power but what we can gather from its effects, from these we have learned that it is in proportion to the tractional force, pressure, energy, or tension, multiplied by the velocity with which the body is impelled by this tractional force, pressure, energy, or tension. We would here beg leave to remark, that it would seem a definite term was wanting to express the simple action, or traction, or pression, or tension, of an agent upon its patient, considered independent of either time, space, or velocity; and, for want of a better, it is proposed that the term *confliction* be adopted to express this action, whether it be a pression or tension; we would then say that mechanical power was measured by multiplying the confliction into the velocity of which the confliction was the cause. Mere pression where no motion is produced, cannot be said to be a transfer of power, for how can power be transferred where none has been consumed? that no power has been consumed is evident, when we consider that the product of two factors is known to vanish the moment that one of the factors vanish. Before motion is produced power has not begun to flow; has not commenced consuming upon itself; but the moment motion is produced power has commenced consuming upon itself.

Now we shall find that a power necessary to overcome a *constant* resistance will not be in proportion to the time, for power being measured by the product of the factors, one of these, viz. the confliction, will be constant, and will be equal to that to which it is opposed, viz. the constant retarding something which we call friction. But the other factor, of which power may be said to be composed (or rather the magnitude which we take as the representative of power) namely, the velocity, will be variable, being as the space described in a given time, and the product of these two factors will be variable, increasing as the velocity increases, and will be in proportion to the space, let the time be what it may.

Having thus shown that a constant retardation, which would be measured by a given tension (the bending of a given spring to a given point, for instance) is that which would require a certain power to overcome it and produce motion, which power is in proportion to the distance passed over, it is hard to conceive how friction can be fairly said to be in proportion to the time.

If we were to regard friction as a something which we might compare to mere tension, it might in this sense possibly be conceived to be independent of either time or space. But when we seek for the amount of friction, the sum total of all its magnitudes, which existed, or which were exerted, or elicited, while passing over a given space, and find that it requires a power to overcome this amount of friction in the proportion of the velocity and confliction jointly, which confliction is equal, and opposite to the retardation caused by friction, we are surely justified in saying that the *amount* of friction is in proportion to the space, for if we were even to refuse to admit, that the friction was in proportion to the space, still the fact, of the *power* necessary to overcome it being found to be in proportion to the space, would not admit those conclusions to be drawn, and those effects upon rail-roads to be anticipated, which have been drawn and anti-

cipated; we have been told (publicly taught,) that at a certain vast velocity, a car upon a rail-road would be borne along by the impulse which had been previously given to it, with hardly any additional consumption of power! We have been also told that a high velocity once attained, it would require no more power to maintain this high velocity than it would a lower velocity!

MINUS WARD.

FRANKLIN INSTITUTE.

Monthly Meeting.

The stated monthly meeting of the Institute was held at their Hall on Thursday evening, November 26, 1829.

MR. JOSEPH M. TRUMAN was appointed chairman, and

WILLIAM HAMILTON recording secretary, pro tem.

The minutes of the last meeting were read and approved.

The following donations were presented, viz.

The Philadelphia Monthly Magazine, vols. 1 and 2.

Essays on Public Charities, by M. Carey, Esq.

Extracts from the Medical Ethics of Dr. Percival.

Observations and Experiments of the Efficacy and Modus Operandi of Cupping Glasses in preventing and correcting the effects of poisoned wounds, by C. W. Pennock, M. D.

A Memoir concerning the Fascinating Faculty which has been ascribed to the Rattlesnake and other American Serpents, by B. S. Barton, M. D.

Rapport sur L'utilité des Paragrés.

Constitution and Laws of the Montreal Mechanics Institute. All presented by Isaac Hays, M. D.

North American Review, vols. 8, 9, and 10, and first part of vol. 11, new series, presented by George Fox, Esq.

First Lessons in Practical Geometry, by W. R. Johnson, presented by the author.

The corresponding secretary laid on the table the following works received in exchange for the Journal of the Institute.

The North American Review, for October, 1829.

The London Journal of Arts and Sciences, for October, 1829.

Gill's Technological and Microscopic Repository, for October, 1829.

Journal des Connaissances Usuelles et Pratiques, for August, 1829.

Journal Universel des Sciences Medicales, for July, 1829.

Bibliothèque Physico-economique, for August, 1829.

Recueil Industriel, for June and July, 1829.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, for July, 1829.

The discussion for the evening being called for, a paper was presented by Mr. Charles Potts, in reply to the query, "What is the proper method of computing the power of high pressure steam en-

gines?" which was received, when, on motion, the reading of it was deferred until the next meeting.

Extract from minutes.

JOSEPH M. TRUMAN, *Chairman.*

WILLIAM HAMILTON, *Recording Secretary, pro tem.*

An examination of the question, 'Does a Body, Descending on an Inclined Plane, with an Accelerated Motion, press the Plane with the same force through every portion of its length?' Read at the meeting held October 22, 1829, by DAVID H. MASON, Machinist.

TO THE FRANKLIN INSTITUTE.

As there exists a diversity of opinion respecting the solution of the question, "does a body descending on an inclined plane with an accelerated motion, press the plane with the same force through every portion of its length," the following remarks may not be out of place.

It is believed that the following propositions need only be stated, and accompanied with diagrams, to be well understood by those who are acquainted with the laws of motion, and resolution of forces.

Proposition 1.—If a body, A, be acted upon by two forces, represented by and in the direction of the lines AB and AC, and those forces continue uniform in their motions, it will take the direction of the diagonal of those forces.

Proposition 2.—The body, A, acted upon by two forces, represented by and in the direction of the lines AB and AC, and those forces are equally accelerated, it will take the diagonal of those forces.

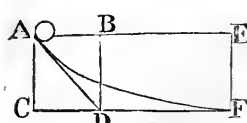
Proposition 3.—The body, A, acted upon by two forces, represented by and in the direction of the lines AB and AC, and those forces are equally retarded, it will take the direction of the diagonal.

Proposition 4.—A body B, acted upon by two forces, represented by the lines BD and BC, the force BD accelerated, and the force BC retarded, it will take the direction of some curve, BE, as the parabola or cycloid.

Proposition 5.—When the body is at E, if it were propelled back again by the forces ED accelerated, and EC retarded, in the inverse ratios of the former proposition, it would retrace the curve EB.

Proposition 6.—A body, C, acted upon by two forces, represented by the lines CE and CD, both accelerated, CE in the ratio of 3, 5, 7, and CD in the ratio of 4, 8, 16, it would take the direction of the curve CF.

Proposition 7.—When the body is at F, if it were propelled back again by these forces, in their inverse ratios, it would retrace the curve FC.



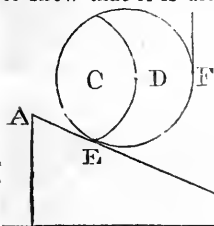
Proposition 8.—A body, A, acted upon by two uniform forces, represented by AB and AC, would take the direction of the diagonal of those forces, but let the force AB be accelerated and represented by AE, and the force AC as before, the body would be carried forward from the plane AD, and take the direction of the curve AF.

That velocity will counteract gravity, sir Isaac Newton avers in his *Principia*, Definition five.

“If a leaden ball, projected from the top of a mountain by the force of gunpowder with a given velocity, is carried in a curve line to the distance of two miles before it falls to the ground, the same, if the resistance of the air was took away, with a double or decuple velocity, would fly twice or ten times as far. And by increasing the velocity, we may at pleasure increase the distance to which it might be projected, and diminish the curvature of the line, which it might describe, till at last it should fall at the distance of 10, 50, or 90 degrees, or even might go quite round the whole earth before it falls, or lastly, so that it might never fall to the earth, but go forward into the celestial spaces, and proceed in its motion *in infinitum*.”

A body sufficiently heavy to break through ice, will cease to do so, if put in a quick progressive motion, which is frequently exemplified by persons skating.

It was judged proper thus far, to give the foregoing propositions of bodies acted upon by two forces, in order to ascertain which of these laws govern a body in descending an inclined plane, or rather, to show that it is dissimilar to either of these laws or propositions.



Let AB represent the plane, and CD the body that is to descend upon it, and that part designated by C, will be equally balanced and rest on the plane. Suppose the part C to be cut off, and the remaining part, D, to be sustained by two supports, one on the plane at E, the other by a cord, or otherwise, at F, the greater portion of the body, D, will be supported by the plane, because that end of the body is the largest, and because the support, E, is lower than the support, F. Thus it is evident that the amount of pressure on the plane will be made by the part C, and the larger portion of D. Now let the parts C and D be joined again, and the support taken from F, all that part of the body unsustained by the plane will fall by the force of gravity, but the plane intercepting opposes the direct gravitating force, constantly resolving it into two forces, one in the direction of gravity, the other in the direction of the plane, and these forces will be equally accelerated, because, when the body has moved half the length of the plane, it has descended half the height of the plane; when one has passed $\frac{2}{3}$, &c. the other has descended $\frac{2}{3}$, &c. Again, that part of the body which is unsustained, and opposed by the plane in its direct descent, will be a constant force added to the velocity, producing

the acceleration in the direction of the plane, the other part will be a constant force added to the velocity, producing the acceleration in the direction of the perpendicular, and these forces must be constant, for the accelerations are uniform, which has just been shown, and if the accelerations are uniform, and the forces are constant, then the pressure on the plane will be a constant uniform pressure.

Again, let BC represent the plane, and A the body that is to descend upon it. Suppose the body to have no gravity, but let the weight, D, be suspended at F, the point of contact on the plane, and the weight, E, at G, to represent the gravity of the body, and let the weight, D, represent that portion of the body sustained by the plane, now it is very clear that the weight, D, has no tendency to move the body forward, but only to press on the plane. All that can move the body is the weight E, which is a direct gravitating force, and would move the body in the direction of gravity; but the plane prevents that course, and compels it to move in the direction of the plane; the weight, E, will be accelerated in its descent, and the body accelerated in the direction of the plane, and these accelerations will be equal as before stated. The weight, D, will remain unaltered, except by its *inertia*, to give greater acceleration to the two forces, therefore "the pressure on the plane will be the same through every portion of its length."

It will be perceived that a body descending an inclined plane with an accelerated motion, is not analogous to proposition 2, because in that proposition the body is acted upon by two forces, and these are composed into one, in the direction of the diagonal of these forces, urging the body in that course, whereas, in the inclined plane, the body is acted upon by one force only, and that force resolved by the plane into two, the body taking the direction of one of these forces.

A body will not descend on a plane in the same time that it would descend in free space, because all that portion of the body that is sustained by the plane, has no tendency to fall, but must be carried along by the part that is unsustained.

It is a curious fact, that when a body is descending an inclined plane, the forces are equally accelerated, notwithstanding the friction of the plane or the resistance of the atmosphere, and it is presumed that a more perfect instance of equal accelerations cannot be found.

From the above, it will be seen that, in the communication on this subject in the September number of the Journal, correct conclusions were drawn from wrong premises.

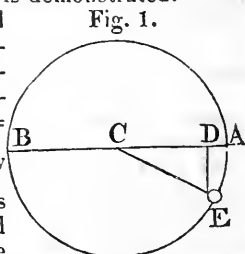
Replies to certain questions submitted to the Monthly Meeting of the Franklin Institute. By CHARLES POTTS, read October 22, 1829.

Reply to the question "What is the absolute centrifugal force of a body revolving in a circle of a given diameter, d , with a given velocity, v ."

The periodic time of a body revolving in a circle, by means of its own gravity at the circumference of the earth, is ordinarily determined to be equal $C \sqrt{\frac{2R}{g}}$; where R is assumed equal the radius of the earth, $g = 16\frac{1}{2}$ feet, and $c = 3.14159$, &c.

As the correctness of this expression depends upon the accuracy with which the terms are assigned in the following theorem, viz. that the central force of a body moving in the periphery of a circle is as the square of the arc divided by the diameter; it may be of use to give the usual manner in which this theorem is demonstrated.

Thus, let the arc AE (Fig. 1.) be described by a body revolving in a circle in a given moment of time; then, from the nature of a circle (the arc AE being very small, and, consequently, nearly equal to its chord) $AE^2 = AB \times AD$, and, therefore, $AD = \frac{AE^2}{AB}$. Now



AD is the space through which the body is drawn from the tangent in the given time; and though $2 \cdot AD$ is the proper measure of the central force, yet when the forces compared are all computed in the same manner, the ratio in both cases will still remain to be the same. Hence, if g (= the space through which a heavy body descends at the surface of the earth in one second of time,) be represented by AD , and AC be put equal R = the radius of the earth, then the space described by the body revolving at the circumference of the earth in one second of time, will be represented by $AE = \sqrt{AB \times AD} = \sqrt{2gR}$ and the circumference of the earth being $2CR$, we have the following analogy; as $\sqrt{2gR} : 2CR :: 1'' : C \sqrt{\frac{2R}{g}}$ = the time in which the body would pass around the entire circumference of the earth, as above stated.

I have adverted to the foregoing theorem because it might be urged that however near the arc AE may be supposed to approach to its chord, it can never be considered as absolutely equal to it; and hence the deductions for the centrifugal force which are predicated upon this supposition, as will be the case in the following remarks, are not such as the question demands: it may not, therefore, be amiss, if greater accuracy is required, to give the following series expressing the arc in terms of the diameter and versed sine, viz. putting $2R = D$; the arc.

$$AE = \left(1 + \frac{g}{2.3 D} + \frac{3 g^2}{2.4.5 D^2} + \frac{3.5 g^3}{2.4.6.7 D^3} + \&c.\right) \sqrt{g D};$$

where the order of the series being evident may be continued at pleasure. This expression being substituted for the value of the arc or the space described by the body in one second of time, the periodic time may be found as in the preceding analogy. Having now the periodic time of a body revolving at the circumference of the earth, it follows, that as the central forces of two bodies moving in different peripheries are in a ratio compounded of the direct ratio of the diameters and the reciprocal one of the squares of the periodical times; if t be put for the time which the body requires to perform one revolution around the circle, the diameter of which is given = d ; then, by the above law, the central forces of the two circles being denoted by F and f respectively, we have $F : f :: t^2 \times 2 R :$

$\left(c\sqrt{\frac{2R}{g}}\right)^2 \times d$ and consequently $f = \frac{C^2 d}{g t^2} \times F =$ the centrifugal force required. Or because the time $t = \frac{Cd}{v}$ we shall have in terms

of F , d , g , and the given velocity, $v. f = \frac{v^2}{gd} \times F =$ the centrifugal force of the body, the weight of which, at the surface of the earth, is equal F .

The solution of this question being essential to the determination of many useful and interesting problems in mechanics, it may be useful to give an example of its application.

Let one of the balls of a governor of an engine weigh 30 pounds; and suppose that it revolves in a circle, the diameter of which is 3 feet, in one second of time.

Here $F = 30$ $d = 3$ and $t = 1''$

Therefore $f = \frac{3 \times 30 \times 3 \ 14159^2}{16\frac{1}{2}} = 55.177$ pounds, the centrifugal force of the ball.

If now it is required to find how long the arm of a governor must be in order that the above conditions may be fulfilled.

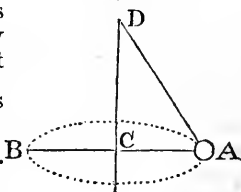
Let the length of the arm $AD = l$. Put $CD = a$ and $AB = d$ as before. Now it is known that $CD : AC$ as the force of gravity on the body, is to the centrifugal force, that is, $a : \frac{1}{2}d :: F : \frac{C^2 d F}{g t^2}$ from whence results

$$a = \frac{g t^2}{2 C^2} = .814, \&c. \text{ in the present case.}$$

But $AD = l = \sqrt{AC^2 \times CD^2} = 1.7$ foot nearly the length of the arm required.

Again, suppose the arm AD of the governor to be $2\frac{1}{2}$ feet long, and the diameter of the circle in which the ball moves to be 3 feet, to find the time the ball occupies in moving round the periphery.

Fig. 2.



54 *Reply to a Question on Descents on Inclined Planes.*

From the above equation, $a = \frac{g t^2}{2C^2}$ we have also $t = C \sqrt{\frac{2a}{g}} =$

1.108 \sqrt{a} = the periodic time of revolution.

Now, by the question $CD = a = 2$ feet.

Therefore $t = 1.108 \times \sqrt{2} = 1.108 \times 1.4142 = 1''.5669$, or one second and a half nearly.

It is obvious that if s be assumed to represent the ultimate centripetal force of a revolving body (the strength of the arms and rim of a fly wheel, for instance,) then by equating this with the general expression for the centrifugal force given above, we may determine the velocity with which a fly wheel (or the like) by the centrifugal force would be torn asunder. In a similar manner, also, it would be easy to assign the relative strength of the arms, &c. when at rest, and when revolving with a certain velocity.

Which will move down an inclined plane with the greatest velocity, a wheel of two, or one of four feet in diameter, supposing their weights the same and the matter of each to be all disposed around in its periphery?

It is evident from the given proportion of the two wheels, that the spaces described by them in passing over the same length of the plane will be equal: for let the length of the plane on which the two wheels are supposed to roll down, be assumed equal to the periphery of the largest wheel; then the space described by the larger wheel in descending this plane, will be equal to that of a cycloid, the base of which is equal to the length of the plane, and axis equal to the diameter of the wheel. The length of this cycloid, it is known, is equal to four times the diameter of the generating circle, therefore the space described by the larger wheel in descending the assumed plane will be equal to sixteen feet. Now as the peripheries of circles are to one another as their diameters, and the diameter of the lesser wheel is half that of the larger, by the question, the length of the plane will be twice the length of the peripheries of the smaller wheel. Hence it follows that the small wheel in passing down half the length of the assumed plane, will describe a space equal to four times its diameter; and in rolling down the whole length of the plane, it will describe a space equal to eight times its diameter, that is, equal to sixteen feet, the same as that of the larger wheel.

With regard to the relative forces of these two wheels down the inclined plane, upon which it is known that their respective times depend, the following may be taken as an evidence of an opinion which is somewhat prevalent in matters of this nature. It is observed in Jacobs' Observations on Wheel Carriages, "that in the draught of carriages ascending inclined planes, the moving power acts not only against the vis inertia, which is always equal to the absolute gravity of the load, but also against its relative gravity, which increases with the inclination of the plane; and with respect to carriages raised on wheels, it is to be observed, that the higher the axle is removed from the plane, the farther is the centre of

gravity removed out of the perpendicular line of support; so that the lower the wheel, the less is the relative gravity of the carriage. Hence it is inferred, that, supposing the friction of two carriages of equal weight, but of different sized wheels, to be equal, the low wheeled one would be drawn up hill, on a smooth plane, much more easily than the high wheeled one, though on a smooth horizontal plane, the latter would be drawn more easily than the former; on the contrary, in going down hill, the high wheeled carriage will be urged forward by its relative gravity more than the low wheeled one."

The fallacy of the above reasoning, applied either to carriages or to the *two wheels in question*, which are analogous, must be obvious, when it is recollected that the power, or relative force that urges a body down an inclined plane, is as the sine of the angle of the inclination of the plane, the weight of the body and the length of the plane being the same in both cases. Hence, when the angle of elevation is the same, as is the case in the present instance, the relative forces of the two bodies are equal. It is, therefore, concluded, that as the velocities of bodies uniformly accelerated are in the subduplicate ratio of the forces and spaces directly, and the weight of the bodies reciprocally, and as these have been shown to be equal, the velocity of the two wheels will be equal. It is hardly necessary to observe, that, in this investigation, the resistance to the two wheels in rolling down the plane has been supposed equal, and the force of gravity uniform.

Does a body descending on an inclined plane with an accelerated motion press the plane with the same force throughout every portion of its length?

In the Journal of this Institute for September last, is published a solution to this query.

The ingenious author of the solution therein demonstrates, by a brief resolution of the acting forces, the affirmative of the proposition.

The Editor of the Journal in controverting the solution, has advanced an opinion, which, if correct, must tend ultimately to overthrow Galileo and all his celebrated demonstrations relative to accelerated motion.

It has been observed, in the remarks of the Editor, after supposing the case of a ball fired from a gun, that "*a rapid motion in the descending body resembles a centrifugal force, and operates in the same way in counteracting the effect of gravity.*"

It is acknowledged by the Doctor in the previous part of his remarks, that "*a body rolling down a plane has its motion accelerated in the same ratio as when falling through free space:*" it will be proper, therefore, to inquire, as the uniformly accelerated motion of a body falling through free space, supposes the accelerating force to be *constant and uniform*, whether the ratio will still be the same, when the accessions of velocity to the body rolling down the inclined plane are supposed to counteract the effect of gravity, that is, whether the motion of the body down the plane will be *uniformly accelerated*.

Let the body be supposed to commence its motion from a state of

rest, and by the effect of gravity upon it, to roll down the inclined plane, the length of which is AB, and height BC.

Now the first impulse or effect of gravity to urge the body down the inclined plane, is $= \frac{BC}{AB} \times W$, where W represents the weight of the body. If, therefore, we can conceive that as the velocity of the body increases in rolling down the plane, the pressure or effect of gravity of the body downwards (which is equal to its weight W,) is counteracted or diminished, it must follow that all the succeeding impulses after the first are continually diminished, and hence it is obvious that the motion thus produced would not be *uniformly* accelerated.

It is proper to observe that in assigning the weight of the body, the limitation is here understood, that the effect of gravity is the same at all heights from the earth's centre. Was this not the case it might be "advantageous" to inquire, supposing the plane to extend to the utmost verge of the sphere of the earth's gravitation, and the body equal in weight to the moon, for instance, to commence its motion at this point, whether the pressure of this body on the plane as it approached the earth, would be nothing, or *less than nothing*; for it follows that if a rapid motion counteracts the effect of *uniform gravity*, every *increment* in the *variable* gravity must have its corresponding counteracting influence.

In considering the question with respect to the force of the descending body on the plane, in a *practical point of view*, it may appear plausible, that, although the force pressing the plane be constant throughout every portion of its length, according to theory, yet the *effect* of this pressure on the plane will not be the same. This paradoxical position may be illustrated in the following manner.

Mr. Buffon and others, in experimenting on timber with a view of ascertaining its relative strength, found that the deflection of beams equal in every respect as to size, texture, &c. increased with the times the weights were acting on them until they broke. Suppose now that an inclined plane had been formed by a series of these equal timbers, resting on props at both ends, and that a heavy body descended thereon with an accelerated motion, would the lower timbers be deflected or bent as much as the upper ones of the inclined plane? The answer must be obvious, if we can place confidence in the experiments above referred to. Here we might reason from effect to cause, and perhaps conclude as in the premised paradox; but it may be more "advantageous" first to ascertain how the fibres of a piece of timber, submitted to any stress, are effected during the time of its action.

In concluding these remarks, it is but justice to observe, that I have constantly borne in mind the sentiment contained in the same number of the Journal, under the article monthly meetings, viz. "error of opinion may be" advantageously "tolerated, whilst reason is left free to combat it," and have, therefore, that this good

end may be obtained, considered the position of the Doctor as having been seriously assumed.

CHARLES POTTS.

Philadelphia, October 22, 1829.

Remarks by the Editor.—The position taken by the Editor in his remarks in the September number, appended to the reply to the query last alluded to, was “seriously assumed;” it was, however, only the impression of the moment, the demonstration having been received and returned by mail the same evening. A little reflection rendered it evident that the conclusion drawn by the Editor was incorrect, yet he was still desirous that the discussion commenced should not be terminated by his immediately crying, “*Peccavi, et confiteor culpas meas.*”

The pressure which a body exerts upon an inclined plane, is certainly independent of the velocity of its motion, as the gravitating force is inherent in the body, and cannot, therefore, like momentum, be affected by velocity; rest, or motion, leaving it unchanged. This pressure has for its value the expression $g \cdot \cos. E$, where g is the entire force of gravity, and E the angle of elevation of the plane; or we may use this form, pressure = $\frac{\text{gravity} \times \text{base of plane}}{\text{length of plane}}$.

Were the body fired from a gun, in the direction of the plane, as supposed in our former remarks, it must be clear, upon the principles which we have admitted, that gravity would still tend to draw the body down from its rectilinear course, with a force which must remain unaffected. As the whole force of gravity during the time of descent is invariable, so certainly must that part of it be which is counteracted by the plane.

On the relation between Rolling and Dragging Friction. Read before the Franklin Institute, at the Monthly Meeting, October 22, 1829. By WALTER R. JOHNSON, Professor of Mechanics and Natural Philosophy in the Franklin Institute.

THE two kinds of friction referred to, may be illustrated by the motion of a cylinder, (Fig. 1,) moved over any plane surface by a force applied, first, opposite to its centre of gravity, and at right angles to its axis, and secondly, opposite to the same centre, but in the direction of its axis. The former force will, if both the cylinder and the plane be perfectly smooth, unyielding, and free from foreign matter, produce a progressive motion only in the cylinder. But in every practical case such an application of force produces likewise a rotation, and, in proportion as the roughness of the surfaces prevents or resists the sliding of one over the other, in the same proportion will the rotary sooner or later correspond to the progressive motion. We may easily conceive, however, that while a body is moving forward with accelerated velocity, that is, while its centre of gravity

advances with increasing rapidity, the revolution on its axis shall be uniform, and the motion of any point on the periphery may, at any given moment, be either greater or less than that of the centre of gravity. Should a cylinder, revolving under such circumstances, come to apply its periphery suddenly to a part of the plane, where, from the roughness of surface, it should be compelled to coincide in its revolving velocity with the motion of progression, it cannot be denied that while the two motions were coming to an equality, a portion of rubbing must take place, and the extent of surface rubbed must be equal to the difference of motion between the centre of gravity of the cylinder and the assumed point of the periphery. Thus, if while the centre traverses a straight line of four feet, the circumference revolved through five, *in the same direction*, then the extent actually rubbed over would be one foot. If it revolved in the opposite direction to that which friction would of itself produce, then we may conceive that each point of the plane passes over some one point of the cylinder, and, therefore, that there is from this cause a friction through four feet of space due to the progressive motion, and again, that each point of the cylinder rubs against some point of the plane, and produces a friction through five feet due to the rotation, and consequently, that the united effects of these opposite motions would be to change the existing rotary motion into one in the opposite direction, by a quantity equal to a direct friction through *nine* feet; that is, through the sum of the two motions. To illustrate the preceding remarks, we may easily suppose a wheel or cylinder to receive a sudden percussion, which shall cause a rapid progressive motion commencing from a state of rest; this motion may generate a degree of rotary motion which may or may not be equal to the progressive velocity, according to the nature of the surface over which it moves. If, after a short time, the surface of the rolling body ceases to touch the plane surface and traverses free space, the rotary motion will continue nearly uniform, while the progressive motion may be greatly retarded, or may entirely cease. If in this case the body comes again in contact with the plane, the uniform rotary motion will generate a friction, which will increase the rectilinear motion, by communicating to the centre of gravity part of that force which had been employed in producing rotation. The case now supposed is precisely that which is seen in ballistics, when a cannon ball, after having received, by traversing the gun, a rotary motion, and subsequently nearly expended its force in overcoming the resistance of the air, is seen to acquire an additional velocity by coming in contact with the ground. A similar transfer of motion from the rotary to the rectilinear direction, through the interference of friction, is seen, when a billiard ball is caused to retrograde on the table, by giving it an oblique stroke downwards in a direction which passes below the centre of gravity. Another example to the same effect is that of a ball falling from a tower at the same time that it revolves on some axis of its own. When it comes to the ground the rotary is converted into a rectilinear motion by the agency of friction, and the ball rolls off horizontally from the spot where it first struck.

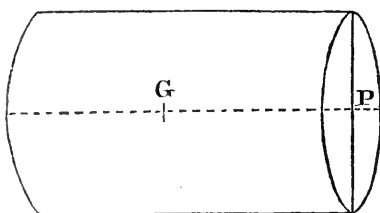
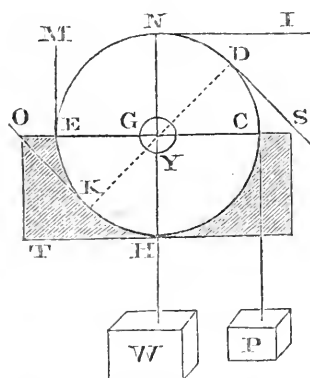
A still more remarkable illustration of rolling friction is presented in the common rolling mill, for converting metals into plates, where it puts in motion not only the bar of metal rolled, but often one of the rollers also, notwithstanding all the friction of its axle.

From what has now been offered, we may conclude that the idea sometimes held out, *that a body rolling along a surface causes no friction*, is not well founded in any physical case where a force is employed to generate rectilinear motion; and can only be true when the motion of rotation *already produced* is precisely correspondent to that of progression. Still the obstruction opposed to progressive motion, by a roller on a plane, is extremely small, and in most practical cases where rollers move on smooth planes, is actually regarded as nothing.

It is not, however, with respect to a rolling friction of this sort that the subject possesses the most practical interest. If the cylinder before supposed were to be moved along a plane by a force applied in the direction GP of its length, (Fig. 1,) and passing through the centre of gravity, G, it would generate a real *dragging friction*.

Fig. 2.

Fig. 1.



The same thing would be true if the solid were laid in a semi-cylindrical groove or hollow (Fig. 2,) and caused to revolve about its axis, its surface being in contact with the concave part of its bed, and pressing it with a force due to the weight of the cylinder. The force, then, which would be necessary to cause this body to revolve, would be equal to that which would be required to drag the cylinder lengthwise along the plane. Every revolution of the cylinder must, therefore, produce the same amount of friction as if its surface were reduced to a parallelogram, and the body were dragged without revolving through its breadth over a plane surface. Such would be the case, if the forces applied to the cylinder to produce rotation were directed in such a manner as neither to increase nor diminish the effect of gravity.

But if a weight were applied as represented at P , (Fig. 2,) it is

obvious that its own gravity would increase the pressure at H, and, consequently, augment the friction caused by the cylinder, so that after allowing for the friction caused by W, (which is here intended to represent the weight of the cylinder,) we must make an additional allowance for P itself, according to the nature of the materials of which the cylinder and the bed, EHC, are composed; this allowance would again cause a new pressure and friction, and thus a decreasing geometrical series of weights must be added at the point C, having for the first term such a part of W as is expressed by the relation of pressure to friction, in the case of the given materials, and for a common ratio of the progression, the fraction expressing the same relation. The sum of all the terms, continued to zero, will be the actual amount of P at the moment when motion commences. The sum of all the terms *following the first*, will be found by *multiplying together the first and second terms of the series, and dividing the product by their difference. The quotient added to the first term gives the sum of the series required.* The applicability of a similar method of computation to the friction on the gudgeons of water wheels, moved by the gravity of water, is too obvious to require demonstration.

If instead of applying a weight at P only, we should apply two equal forces, one in the direction of CP, and the other in that of EM, the amount of friction, caused by the former, would be relieved by the latter, and consequently, the sum of the two forces would be only the friction of the cylinder. The same would be true if the forces were to take either the directions NI and HT, or KO and DS, respectively. Supposing the cylinder to be placed on an axis smaller in any given proportion than its own diameter, as GY, then the whole effect of gravity would be transferred to this axis, and if this were to be caused to revolve by a force applied tangentially to the axis itself, it must be of the same magnitude as that which had before been applied to the cylinder when placed in the groove. But if applied to the exterior of the cylinder, it must be as much less than before, as the diameter of the axis is less than that of the cylinder. In other words, the difficulty of overcoming friction at the axle, is to that of overcoming the same at the outer periphery, when confined in a bearing, as the diameter of the axle is to that of the cylinder. If D be the diameter of the cylinder, d of the axle, and F the relation of weight to friction, we shall have the proportion

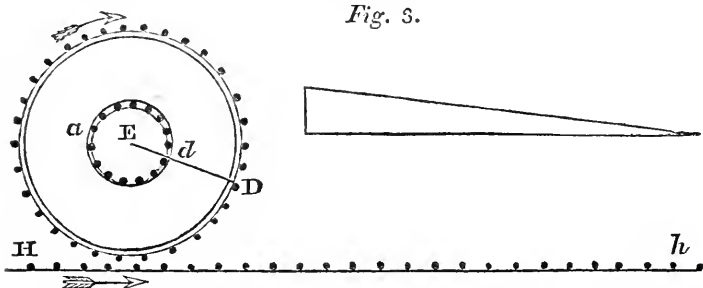
$$D : d :: F : \frac{dF}{D} = \text{the force required to overcome the friction on the axle.}$$

It will strike those who consult authorities on this subject, that writers of much credit differ among themselves as to the manner in which this resistance is to be represented. In the article on this subject in Rees' Cyclopaedia, we read that "the friction which the wheel would have against its supporting plane, if it did not turn round its axis, is by its turning round, transferred almost wholly to the axis and nave, whose circular motion is, notwithstanding, so much slower. It is, indeed, notorious, that the great friction of the wheels of carriages lies between the axle and naves, and how then can it be properly asserted that such friction is diminished at the axle as the velocity of the cir-

cular motion is there diminished? Accordingly, it has been alleged by a late writer that friction is not diminished by the use of wheels, but merely transferred from the outer surface of the wheels to its nave and axle, and that in the case of a wheel rolling on the ground, the spokes act only as single levers to overcome the friction of the periphery."

This appears to be little more than a quibbling about terms, since, whether we choose to assert that the friction is diminished because the axle moves slowly in the box, and its moment is thereby diminished, or to say that the resistance of friction is overcome by the power of the lever, the two arms of which are the radii of the wheel and axle respectively, we do but express one and the same thing—proceeding from one and the same cause, namely, the diminution of the size of the axle. This will be illustrated by Fig. 3, where the

Fig. 3.



horizontal plane Hh , is represented as furnished at equal distances, with small balls or prominences so attached to its surface as to present equal obstructions to the dragging of heavy bodies along that surface.

The exterior of the wheel, ED , is likewise represented as furnished with equal prominences at equal distances. When, therefore, the wheel is compelled to make one revolution without advancing, as many prominences would be broken from its periphery as would be dislodged from the plane surface while it advanced, without revolving through a space equal to its circumference. But when the wheel is allowed both to revolve and to advance in such a manner as to apply its periphery to a length of plane just equal to the space traversed by the centre, the prominences will be geared together like the teeth of a rack and pinion. But in the latter case the prominences may all remain unbroken. But when the wheel rests with its whole weight on an axle, as ad , the number of prominences which can be disposed at the same distances as before, on the circumference of the axle, will be diminished, in proportion as the radius Ed of the axle is smaller than ED , that of the wheel.

Some persons have maintained, that when a cylinder merely rolls along a surface, without being attached to an axis, there is, in reality, no friction, and that the whole question about rolling and dragging friction, is, therefore, futile. It is true that when a wheel or cylinder rolls on a surface as nearly *plane* as it is possible for art to

produce, the amount of friction, being no more than is due to the moment of inertia, is extremely small, compared with that of dragging, but the observations already made, and the examples cited, will be sufficient to show that the actual advancement tends, by a force equal to that which produces the rotation, to break down the prominences of the surface, for if we consider the cylinder rolled forward by a fine thread unrolled from its upper side, we may consider also the plane beneath to oppose a force tending to draw it in the opposite direction, and this force is friction. I would here notice an error which appears to me to have been made by Wood in computing the friction of his carriages, in No. 10 of his experiments, (Wood on rail-ways, pages 190, 194,) where the wheels, carriages, and loads descended by their gravity. He has added the weight of the wheels and axles to that of the carriages and loads, and, when comparing the sums to determine whether friction increased with the weight, he has taken the whole weight in the same manner as if he had been computing the friction of a sledge descending on an inclined plane. If he had first taken the wheels and axles separately, allowed them to descend on the plane, and noted how much more slowly they descended than what would be due to the angle of the plane's inclination, he might have found what was due to the carriage and load, and which is, in truth, the only part to be ascribed to *pressure on the axles*. If we suppose the wheels and axles only to be placed on a plane so little inclined as just to continue their rolling motion, and afterwards on another so much inclined as just to cause a car to descend with all the friction of its axles, we shall readily conceive that, in the latter case, the wheels will descend with a constantly accelerated motion, and might, therefore, overcome a certain portion of the resistance of the carriage. If, then, the wheels serve the purpose of dragging the load downwards against the resistance of friction, it is certainly improper to suppose them part of the retarding cause, and to compute their effect as such. The wheels and axles used by Wood weighed 11 cwt., which, on a plane inclined by an elevation $\frac{1}{104}$ parts of its length, would, doubtless, if disincumbered of their cars, have acquired a velocity far greater than that which his experiments actually gave to the cars.

Thus, in every case where we would compute the effect of friction by comparing the actual distance passed over by a carriage, with the theoretical descent as caused by the inclination of the plane, we must consider the weight of the car and load as the cause of friction on the axle, and the gravitating power of the wheels as aiding to overcome the friction occasioned by the load. His formula, therefore,

$$F = G - \frac{WS}{rl^2}$$

must be modified in such a manner as to allow for the influence of the wheels and axles in dragging the load down. It is not enough to subtract the weight of the wheels in each case from the total weight of the car and wheels. We must actually compute the separate influence of the latter, and add it to the amount of the friction observed to take place in the combined machine. The wheels must be regarded as a weight attached to a cord and hanging

over a pulley at the lower end of the plane. This would present the formula under the following aspect, where a is the amount of retardation suffered by the wheels when attached to the car, *more than* when they roll down resisted by no other friction than that at their

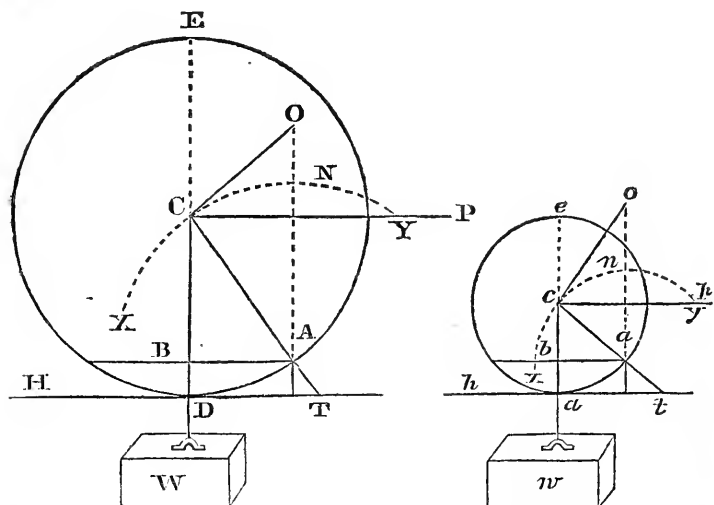
peripheries. $F = G - \frac{WS}{rt^2} + a$. The quantity of resistance at

the peripheries will, it is true, vary with the pressures, and the only mode of determining the law of this variation would be to suspend, successively, on the *axis* of the wheels, (which I suppose to be fastened in the naves,) by their centres of gravity, heavy cylinders of different weight, equal to the loads which the wheels would sustain in their car, and to cause those cylinders to descend over the road revolving with, and resting wholly on, the wheels. This might easily be effected by employing cast-iron carriage wheels with which to load the axles, and putting on so many to the same axle as might be sufficient to answer the purpose. By a careful investigation of the subject after this manner, we might apply the correction a with the proper allowance, or farther correction, for the difference of pressure when the wheels descend by themselves, and when they go down pressed by the car and load. The result of Wood's experiments on the inclined plane show how important this correction is, since his 5 experiments made in this manner, give an average of $\frac{1}{212}$ for the amount of friction, while the 8 made by the dynamometer give $\frac{1}{199}$ as their average, the latter being reduced to the conditions of the horizontal plane. I may remark, also, that the axles of those wheels with which he made his experiments on the inclined plane, were larger in proportion to the diameters of the wheels themselves than those with which he experimented by the dynamometer; so that when we come to consider the two cases as reduced to dragging friction, by dividing each by the ratios of diameter of wheels to diameter of axles, we obtain for the average of one set of experiments 16.1 to 1, while for the other we have 18.2 : 1, to express the relation between the weight and the friction of metal rubbing on metal. Thus a portion of between *twelve* and *thirteen per cent.* of the friction, which would have been manifest on the horizontal plane, was overcome and rendered imperceptible by the gravitating force of the wheels and axles. I would observe, in passing, that when we experiment on friction by means of inclined planes, we must consider that the relative pressure only of the body on the plane is to be compared with the force which tends to make it slide; but when we make use of the horizontal plane, we must regard the whole force of gravity as acting to produce friction. The small triangle, (Fig. 3,) will serve to express by its base and perpendicular the relation between relative pressure and friction when a body moves down the hypotheneuse.

I have already noticed some inaccuracies in the books which treat on this subject. It appears to me that in speaking of the advantage of a wheel in surmounting a fixed obstacle, there has been a similar mistake, and the erroneous statements made in consequence might lead some persons to place a wrong estimate on the carriage wheel, as well as on the nature of its friction.

It is laid down by Playfair, (*Outlines of Natural Philosophy*, page 103, vol. 1,) and cited in a note by Dr. Bigelow, (*Elements of Technology*, page 196,) that “the plane on which a carriage moves and the line of draught, being both horizontal, the advantage for surmounting an immoveable obstacle of a given height is as the square root of the radius of the wheel.” I think it will appear, from what follows, that this supposition is erroneous, in cases where the wheel is to mount directly over the obstacle without rolling up an inclined plane to attain its elevation. Let Fig. 4 represent two wheels of

Fig. 4.



different heights, intended to surmount the equal obstacles TA and ta . Let the weights W and w be the same for both wheels, and the powers P and p be such as to produce an equilibrium in the wheels DAE and dae respectively. Then by a well known law in mechanics, when three forces are in equilibrium, each is represented by the *sine of the angle comprehended between the directions of the other two*. As the direction of gravity and that of the horizontal line of traction are at right angles to each other, the sine of the angle comprehended between their directions is equal to *radius*, and is, therefore, represented by CA or ca . Again, the horizontal force is represented by the sine of the angle BCA or bca , which is the line BA or ba , while the vertical force or gravitating power of W is represented in the two cases by the sines of BAC and bac respectively, which are the lines BC and bc . These two forces multiplied respectively by the distance at which they act, in a perpendicular direction from the point A or a , about which the wheel must revolve, in order to surmount the obstacle, ought to give equal moments to those of W mul-

multiplied by BA and ba . Hence $BA \times W = BC \times P$, or $P = \frac{BA \times W}{BC}$

and $ba \times W = bc \times p$, or $p = \frac{ba \times W}{bc}$. In order, therefore, to

know the absolute values of P and p , we must determine the actual lengths of BA and BC , of ba and bc . BC is easily found by subtracting the perpendicular height of the obstacle from the radius, and BA is found by subtracting the square of BC from that of AC , and extracting the square root of the remainder. Thus $CA^2 - BC^2$

$= BA^2$. But $BC = CA - BD$, therefore $BC^2 = CA^2 - 2 CA \times BD + BD^2$. Substituting this value of BC^2 in the equation $CA^2 - BC^2 = BA^2$, we have $CA^2 - CA^2 + 2 CA \times BD - BD^2 = BA^2$, or $2 CA \times BD - BD^2 = BA^2$; hence $BA = \sqrt{2 CA \times BD - BD^2}$. The value of P , therefore, must be $\frac{W \times \sqrt{2 CA \times BD - BD^2}}{BC \text{ or } (CA - BD)}$

which is now expressed in terms of the radius and versed sine. Substituting R for the radius of the larger wheel and r for that of the smaller, as also h for the perpendicular height of the obstacle,

the above expression of the value of P becomes $\frac{W \times \sqrt{2 R h - h^2}}{R - h}$,

and by a course of reasoning precisely similar, we obtain $p = \frac{W \times \sqrt{2 r h - h^2}}{r - h}$. Hence $P : p :: \frac{W \times \sqrt{2 R h - h^2}}{R - h}$:

$\frac{W \times \sqrt{2 r h - h^2}}{r - h}$, and as both terms of this ratio are multiplied by the quantity W , supposed to be constant, we obtain $P : p :: \frac{\sqrt{2 R h - h^2}}{R - h} : \frac{\sqrt{2 r h - h^2}}{r - h}$. But the expression of Playfair would

be $P : p :: \frac{\sqrt{2 h}}{\sqrt{R}} : \frac{\sqrt{2 h}}{\sqrt{r}}$. This can only be true when the wheel, instead of surmounting the obstacle directly, rolls up an inclined plane

to effect that purpose parallel to the chord AD , (not represented in the figure) and of a length proportional to it, or when h becomes infinitely small with respect to R or r . The expression $\sqrt{2 R h - h^2}$ is equal to BA and $2 R h - h^2 = BA^2$ as above stated. Transposing h^2 in this equation, we obtain

$BA^2 + h^2 = 2 R h = AD^2$ } hence $AD^2 : ad^2 :: 2 R h : 2 r h$, or $AD^2 : ad^2 :: R : r$ and $AD : ad : \sqrt{R} : \sqrt{r}$. If then it be true that the advantage of a wheel, in surmounting a given obstacle, is directly proportional to the length of the chord drawn from the lowest point of its periphery to the top of the obstacle, we may grant that the proposition in question is true also. But as before shown, $P : p :$

$\frac{\sqrt{2 R h - h^2}}{R - h} : \frac{\sqrt{2 r h - h^2}}{r - h}$, or, as the sine of the angle DCA divided

by the cosine of the same angle. And since the relation of sine to cosine is the same as that of tangent to radius, we may substitute the proportion $P : p :: \frac{\text{Tang. DCA}}{R} : \frac{\text{Tang. } dca}{r}$. We may be as-

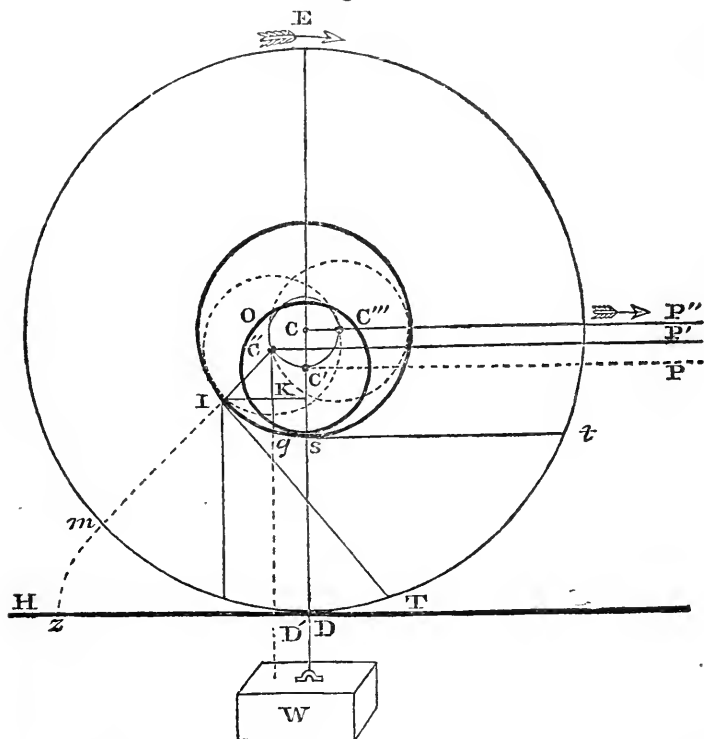
sured that this statement is true, when we consider that the centre of gravity of the wheel where we suppose the force P or p , to be applied must describe the curve CNY or cny , and that it must commence its motion in the direction CO or co , Fig. 4, and that the greatest effort will be required when the centre is at C and c respectively. But the tangent CO , which expresses the length of the inclined plane which the weight begins to surmount, is of the same magnitude as the tangent DT of the angle DCA , and the successive planes will be more nearly coincident with the horizontal line. Having, on the foregoing principles, determined the effect of obstacles which oppose the rolling of a wheel, we may proceed to consider the influence of that resistance on the quantity of friction at the axle. And here again I must remark, that some indistinctness seems to pervade the minds of *theoretical*, and often a total misapprehension of the subject, those of *practical* mechanics.

Bossut tells us that "rolling and dragging friction are combined at the axis of a wheel, and that there thus results a sort of *mixed friction*, because every point of the axis of the wheel describes a straight line (since it has not a rotation) equal and parallel to that which the periphery would describe if it were to slide on the ground, while, at the same time, every point of the box must, in succession, apply itself to some point of the axle." But if we consider that the wheel of a carriage is, in respect to its friction, under precisely the same conditions as the mechanical power called a *wheel and axle*, and that the mere circumstance of the motion of transportation cannot affect the nature of the friction on the axle, we shall be led to infer that this statement of the eminent French philosopher is not well founded.

As carriage wheels are ordinarily constructed, and as roads, and especially rail-roads, are commonly made, the resistance of obstacles at the circumference is much more easily overcome than that of friction at the nave. Thus in Fig. 5, where the wheel $mDTE$ turns on its axle, as O , the line or spoke sD becomes the proper representative of a suspended lever, impelled at the upper end in the direction of PC' by the resistance of friction at s , and at the lower by the resistance of opposing obstacles, (the amount of whose resistance I have just stated,) in the direction DH . It generally happens, however, that, except on very rough roads, the resistance from the latter cause, is less than that from the former. Hence, the wheel commences its forward motion sooner than the axle begins to slide in the box; so that its sliding motion is not (except in cases of great resistance at the periphery,) in the direction of the tangent st , but in that of some other line at IT . The axle then, ought to be found bearing not on the bottom, but on a part *back of the lowest line of the cylinder*. Having been led to this conclusion from the theory which I have now developed, I was induced to inquire of several wheelwrights, coach-

makers, carriage-smiths, and keepers of livery stables, whether they had ever noticed the fact, or whether they supposed it to be true, that the axle *did* rest in its box, elsewhere than on its lowest part; all, after a moment's reflection, answered, that as a force was applied to draw it forward, it must press and be most worn against its front and lower side; but upon examining the old axles in their possession, they have uniformly found my statement to be confirmed by testimony which they could not doubt. In moving a carriage, then, the animal exerts his strength to bring the axle into such a position that it will descend by the gravity of the load along an inclined plane

Fig. 5.



as if to follow some direction, as IT. If the axle be smaller than the box, so as to leave considerable space between them, the centre may retreat from the vertical C'D, ascending at the same time from C' to C'', where it exercises a gravitating force due to the weight, and in the direction C'' D', acting of course on the arm of the lever equal in length to D', D. and which would, if the force P were relaxed, cause the wheel to retreat and again depress the point m towards z, describing the portion mz of a cycloidal curve. This effect is often observed to take place, but most persons are entirely unable

68 On the Relation between Rolling and Dragging Friction.

to account, on the popular supposition of the *forward bearing* of the axles, for this movement of the load. This position of the axle likewise accounts for the *retrograde rotation* of a wheel which is sometimes observed to take place through a portion of a revolution, when a heavy load first passes from rough ground to smooth ice. The gravitating force, when the centre takes the position C'' , may be resolved into $C''I$, perpendicular to the side of the box, and the inclined tangent Ig , then the force which presses the surface, causes the friction, and opposes motion, is less than when it lies on the horizontal plane st , and the friction is diminished in proportion as $C''I$ is less than $C''g$. Again, as the force P_{now} acts in the direction $C''P'$, it tends to relieve even the remaining portion $C''I$, in the ratio of that line to $C''K$. When the force necessary to surmount the obstacle becomes infinite, the centre of the axle will take the position C''' , but this can happen only when the height of the obstacle is equal to the radius of the wheel. The tangent of the angle formed at the centre will then be infinite also, and the expression

before given, viz. $P = \frac{\text{Tang. } DCA}{R}$, will be as applicable to this case

as to any other. But if the advantage of the wheel were simply as the square root of the radius, a wheel of one foot radius acting against an obstacle one foot high, would possess half as much advantage to overcome that obstacle as a wheel of four feet radius, which is obviously absurd, since the latter is finite and the former infinitely small, or rather equal to 0. These considerations will enable us to account in some measure for the smallness of the ratio of friction to pressure ($\frac{1}{17}$) as given by the experiments of Wood and Stevenson, which is well known to be far below what it was represented by Belidor, Muschenbroëk, Amontons, Coulomb, Vince, and many others; besides which, it will be recollected, that those experiments were made on wheels actually in motion, and that according to Euler, the relation of the resistance to motion in that case, is to that which opposes the commencement of motion, only as 1 to 2.

The conclusions drawn from the foregoing remarks, are, that the friction of a roller moving over a horizontal surface depends on the relation between the velocity of the periphery and that of the centre of gravity also, that this relation between the tangential velocity and that of transportation, will depend on *the moment of inertia of the cylinder*.

Again, the advantage of a wheel over a sledge, where the same materials are employed to slide over each other as those which compose the box and axle, is *as the diameter of the wheel to that of the axle*.

If friction wheels be employed, the ratio just stated must be multiplied by the relation between their diameter and that of their axles.

The amount of friction at the axle to be overcome by the moving force, will be proportional to the weight of the load, but will depend also on the obstacles which oppose the progressive rotation, and will attain its *maximum* when the height of the obstacle is equal to the

radius of the wheel, at which moment the advantage of the wheel to surmount the obstacle is a *minimum* or *zero*.

The advantage of a wheel to overcome any obstacle of a given height when the plane over which the wheel moves, and the line of draught, are both horizontal, will be *as the tangent of the angle formed by a vertical drawn from the centre of the wheel downwards, and another line drawn from the same point, to the top of the obstacle, divided by the radius of the wheel*.

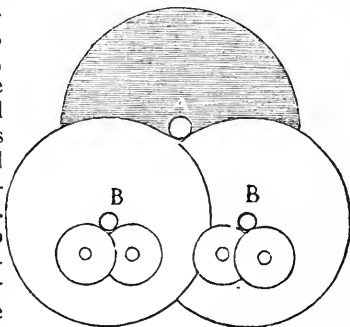
Modern Antiques. By the EDITOR.

UNDER this title we propose to furnish, occasionally, some palpable evidences of the forestalling disposition of our remote ancestors, who have, in numerous instances, deprived us, and our cotemporaries, of the honour of being the *true and original inventors, or discoverers*, of various improvements in mechanics, and other useful arts; and who even peep from their graves to dispute the rights of those who have issued to the world their new born projects in the form of letters patent, under the sign manual of presidents and kings. This is certainly a grievous case, and, unfortunately, not less common than grievous, and one which scarcely admits of a remedy; a deaf ear is turned to our remonstrances, and there seems to be nothing left to us but to appeal to "impartial posterity."

We have selected as the first evidence of the justice of our complaints,

The application of Friction Wheels to Carriages, and other purposes.

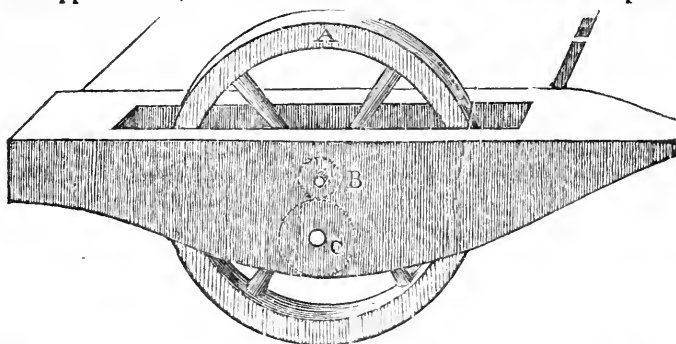
Friction wheels were recommended by Casatus, and afterwards mentioned by Stermius and Wolfius, about the middle of the seventeenth century, and were applied to actual use in clocks, by Sully, in the year 1716. Mondran applied them to cranes in 1725. In the 4th volume of the *Machines Approuvées par l'Academie Royale*, for the above year, there is a plate of Mondran's crane; the portion of it which is intended to diminish friction, is represented in the subjoined cut. A is a wheel on the axis of the drum, around which the rope winds which is to sustain the load. This wheel is surrounded by cogs, and turned by a pinion, or lantern, which are not represented in the drawing. The axis of this wheel and drum rest upon the peripheries of the friction wheels, B, B, and these again upon the smaller friction wheels shown in the drawing. M. Mondran does not pretend to be the inventor of the friction rollers, but merely proposes to apply to cranes a contrivance before known. He says, "the beneficial effect of this invention has been experienced in many machines to



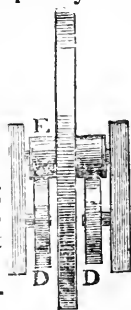
which it has been applied. We find in the *Memoirs of the Royal Society of Berlin*, published in 1710, a similar mode of preventing friction applied to pumps, since which time it has been used in clocks, and other machines, with perfect success."

"This manner of removing friction is not, perhaps, admissible in all cases, and particularly in machines intended for raising great weights, because the axis of the upper wheels acting directly downwards, must necessarily have a tendency to separate the friction wheels; the machine, nevertheless, is calculated to be *extensively* useful."

The next article in the same work, and under the same date, is a proposition by M. Mondran, to apply friction wheels to carriages. "This method," he observes, "of diminishing friction, consists in supporting the axis of a wheel upon two rollers only, instead of upon the four employed in the preceding method. A, is one of the wheels of a carriage, running in a suitable frame, there being a similar wheel on the opposite side; in each of the frames friction wheels are so placed,



that the weight sustained by the axis of the wheel, B, may act vertically upon the axis of the rollers, C. This is shown more plainly in the profile, where the axle tree, E, is seen resting upon the two rollers, D, D; and in order that each axle may always keep its proper bearing, two trunnions are fixed within the edges of the openings through which it passes; they are so placed as by their lateral action to cause the weight to act vertically on the axis of the rollers, D D. There will, therefore, be no tendency in the rollers to separate, as in the preceding machine. It necessarily follows that these rollers must have sufficient strength to sustain the weight which they are destined to bear perpendicularly."



We apprehend that this was actually the first proposition for the application of friction wheels to carriages, and we also apprehend that the mechanician has already seen that the friction wheels are placed upon the wrong side of the axle. M. Mondran had made his second machine upon paper, without advert-
 erting to the fact that, in the carriage, the load must press the axis

in a direction the reverse of that of the crane. All that is necessary, therefore, to make the description correct, is, to invert the figures; we did not feel ourselves at liberty to do so in our copy, particularly as it appears to us that the mistake of M. Mondran tends to show the originality of the proposition.

We cannot see the difference between the friction rollers above proposed, and those recently claimed as novelties by certain patentees.

Zoological Weather Glass.

AT Schwitzengen, in the post-house, we witnessed for the first time what we have since seen frequently, an amusing application of zoological knowledge, for the purpose of prognosticating the weather. Two frogs, of the species *Rana arborea* (tree frog,) are kept in a glass jar about eighteen inches in height and six inches in diameter, with the depth of three or four inches of water at the bottom, and a small ladder reaching to the top of the jar. On the approach of dry weather, the frogs mount the ladder, but when wet weather is expected, they descend into the water. These animals are of a bright green, and in their wild state here, climb the trees in search of insects, and make a peculiar singing noise before rain. In the jar they get no other food than now and then a fly, one of which, we were assured, would serve a frog for a week, though it will eat from six to twelve in a day if it can get them. In catching the flies put alive into the jars, the frogs display great adroitness.

[*Mag. of Nat. History*, iv. 479.]

Extraordinary effects of an Earthquake at Lima, in 1828. Communicated by CAPTAIN BAGNOLD.

DEAR SIR,—Having experienced, during my residence at Coquimbo, on the coast of Chili, no less than sixty-one smart shocks of earthquake in twelve months, without taking minor ones into consideration, I was induced to obtain, from an officer of H. M. S. Volage, the particulars of the destructive visitation which occurred at Lima in 1828. As one of the effects produced appears to me worthy of record, I transmit it to you for a place in the Journal.

On the 30th of March, H. M. S. Volage was lying moored with two chain cables in the bay of Callao; the weather was remarkably fine and clear, when, at half past seven o'clock, a light cloud passed over the ship—at which moment the noise usually attendant on earthquakes in that country, resembling heavy distant thunder, was heard; the ship was violently agitated; and, to use the words of my informant, "*felt as if placed on trucks, and dragged rapidly over a pavement of loose stones.*" The water around "*hissed as if hot iron was immersed in it;*" immense quantities of air-bubbles rose to the surface, the gas from which was offensive, resembling, to use my friend's phraseology again, "*rotten pond mud;*" numbers of fish came up

dead along side; the sea, before calm and clear, was now strongly agitated and turbid; and the ship rolled about two streaks, say fourteen inches, each way. A cry of "there goes the town," called my friend's attention towards it: a cloud of dust, raised by the agitation of the earth and the fall of the houses, covered the town from view, whilst the tower of the garrison chapel, the only object visible above the dust, rocked for a few seconds, and then fell through the roof; and, from the high perpendicular rock at the north end of the island of St. Lorenzo, a slab, supposed thirty feet thick, separated from the top to the bottom of the cliff, and fell with a tremendous noise into the sea. The wharf, or pier, was cracked three parts across, showing a chasm of eighteen inches wide; the chronometers on shore, except those in the pocket, and most of the clocks, stopped, whilst the rates of chronometers afloat, were, in many instances, altered. A great number of lives were lost; amongst whom were four priests, killed in the churches, one of them by the falling of an image, at whose base he was at prayer.

The Volage's chain cables were lying on a soft muddy bottom in thirty-six feet water; and, on heaving up the best bower anchor to examine it, the cable thereof was found to have been strongly acted on, at thirteen fathoms from the anchor and twenty-five from the ship. On washing the mud from it, the links, which are made of the best cylinder wrought iron, about two inches in diameter, appeared to have undergone *partial fusion* for a considerable extent. The metal seemed run out in grooves of three or four inches long and three-eighths of an inch diameter, and had formed (in some cases, at the ends of these grooves, and, in others, at the middle of them) small spherical lumps, or nodules, which, upon scrubbing the cable to cleanse it, fell on the deck. The other cable was not injured, nor did my friend hear of any similar occurrence amongst the numerous vessels then lying in the bay. The part of the chain so injured was condemned, on the vessel's being paid off at Portsmouth, and is now in the sail-field of the dock yard; and I should think a link of it would be worth preserving in the museums of the different scientific bodies.

That the phenomena of earthquakes are produced by volcanic explosion, there can be little doubt; and that they are frequently accompanied by powerful electric action, has long been known: to which of these causes are we to look for the powerful effects here witnessed?

I remain yours, faithfully,

THOS. BAGNOLD.

Knightsbridge, June 14, 1829.

Preparation of Sugar from Starch.

M. WIENRICH, says, that from one to two parts of sulphuric acid for each 100 parts of potato starch, is sufficient, if the heat applied be a few degrees above 212° F; and also that then two or three hours are sufficient to give crystallizable sugar. He applies the heat in wooden vessels, by means of steam.

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AMERICAN AND OTHER PATENTED INVENTIONS.

FEBRUARY, 1830.

Experiments on the Friction and Abrasion of the Surfaces of Solids.

By GEORGE RENNIE, Esq. F. R. S.

From the Transactions of the Royal Society.

Continued from page 12.

TABLE IX.—*Experiments on the Friction of Axles without
and with Unguents.*

Wt. on axle.	Weight required to move it.	Time.	Proportion.	Space passed over.
Gun Metal on Cast Iron.				
cwt.	lbs. oz.	sec.		
1	16 0	90	7.00	4½ inches.
2	30 0	...	7.46	
3	44 0	...	7.63	
4	60 12	...	7.37	
5	112 0	80	5.00	
6	134 0	90	5.01	
7	<div style="display: inline-block; vertical-align: middle;"> After remaining 12 hours it took to move it. </div> } 154 0	...	5.09	
8		...	5.12	
9		...	5.04	
10		...	4.70	

Experiments on the Friction of Axles without and with Unguents.

Wt. on axle.	Weight required to move it.		Time.	Proportion.	Space passed over.
Yellow Brass on Cast Iron.					
cwt. 10	lbs. 272	oz. 0	sec. 90	4.11	4½ inches.
Cast Iron on Cast Iron.					
cwt. 10	lbs. 173	oz. 8	sec. 90	6.45	4½ inches.
11	228	0		5.40	
Cast Iron on Cast Iron with Black Lead.					
cwt. 11	lbs. 161	oz. 0	sec. 90	7.65	4½ inches.
Gun Metal on Cast Iron with Black Lead.					
cwt. 11	lbs. 170	oz. 0	sec. 90	7.24	4½ inches.
Yellow Brass on Cast Iron with Black Lead.					
cwt. 1	lbs. 14	oz. 12	sec. 90	7.59	4½ inches.
2	31	4		7.16	
3	47	8		7.07	
4	65	8		6.83	
5	84	0		6.66	
11	181	0		6.80	
Gun Metal on Cast Iron with Oil.					
cwt. 11	lbs. 218	oz. 8	sec. 90	5.63	4½ inches.

Experiments on the Friction of Axles without and with Unguents.

Wt. on axle.	Weight required to move it.	Time.	Proportion.	Space passed over.
Yellow Brass on Cast Iron.				
cwt.	lbs. oz.	sec.		4½ inches.
½	1 8		37.33	
1	3 8		32.00	
2	7 0		32.00	
3	16 8		20.36	
4	24 8	90	18.28	
5	29 4		19.14	
10	193 8		5.78	
11	200 12		6.13	
Cast Iron on Cast Iron.				
cwt.	lbs. oz.	sec.		4½ inches.
10	131 1	90	8.54	
11	140 0		8.80	
Cast Iron on Cast Iron with Hogs-lard.				
cwt.	lbs. oz.	sec.		4½ inches.
10	117 4	90	9.55	
Yellow Brass on Cast Iron.				
cwt.	lbs. oz.	sec.		4½ inches.
½	1 10		34.46	
1	3 1		36.57	
2	7 8		29.86	
3	23 0	90	14.60	
4	43 0		10.41	
5	47 8		11.78	
10	120 8		9.29	
Gun Metal on Cast Iron with Hogs-lard.				
cwt.	lbs. oz.	sec.		4½ inches.
10	130 4	90	8.59	

Experiments on the Friction of Axles without and with Unguents.

Wt. on axle.	Weight required to move it.	Time.	Proportion.	Space passed over.
Yel. Brass on Cast Iron with Anti-attribution Composition.				
	cwt.	lbs. oz.	sec.	
	1	7 8		14.93
	2	9 0		24.88
	3	10 8		32.00
	4	12 8		35.84
	5	14 8	90	38.62
after remaining 41 hours in a state of rest with fresh composition being applied	10	it took 190 0		5.89
	10	it took only 23 8		47.65
	10	again 20 0		56.00
Yellow Brass on Cast Iron with Tallow.				
cwt.	lbs. oz.	sec.		
1	3 1		36.57	
2	5 12		38.95	
3	8 5	90	40.42	4½ inches.
4	11 1		40.49	
5	13 12		40.72	
Yellow Brass on Cast Iron with Soft Soap.				
cwt.	lbs. oz.	sec.		
½	2 2		26.35	
1	3 8		32.00	
2	6 0		37.33	4½ inches.
3	9 8	90	35.36	
4	12 12		35.13	
5	14 12		37.96	
Yellow Brass on Cast Iron with soft Soap and Black Lead.				
cwt.	lbs. oz.	sec.		
½	5 8		10.18	
1	9 3		12.19	
2	12 1		18.56	4½ inches.
3	14 4	90	23.57	
4	19 8		22.97	
5	23 8		23.82	

Remarks on the Experiments without Unguents.

From the foregoing experiments it appears—

That when gun metal without unguents is loaded with variable weights of from 1 to 10 cwt., friction varies nearly in the proportion of $\frac{1}{3.63}$ to $\frac{1}{4.76}$ of the pressure.

That length of time scarcely affects it.

That friction increased when yellow brass was tried.

That friction decreased when cast iron was tried.

That friction diminished still more when black lead was used between the three different metals.

Remarks on the Experiments with Unguents.

That gun metal on cast iron, with oil intervening and a weight of 10 cwt. amounted to $\frac{1}{3.63}$ of the pressure.

That when the insistent weights were diminished, the friction with oil was reduced to $\frac{1}{3.733}$, but increased with an increase of weight.

That cast iron on cast iron, under similar circumstances, showed less friction.

That the friction of cast iron on cast iron was still further diminished by hogs-lard.

That the friction of yellow brass on cast iron was increased by light weights and diminished by heavy weights, perhaps from being less fluid and sensible in the one case, and more capable of preventing the contact of metals in the other.

That gun metal on cast iron with hogs-lard gave less friction than with oil.

That yellow brass on cast iron with anti-attribution composition of black lead and hogs-lard, increased friction with light weights, and greatly diminished it with heavy weights, showing extremely irregular results.

That yellow brass on cast-iron with tallow gave the least friction, and may, therefore, be considered the best substance under the circumstances tried.

That yellow brass on cast iron with soft soap gave the second best result, being superior to oil.

That yellow brass on cast iron with soft soap and black lead gave the worst result, diminishing the friction in the inverse ratio of the weight.

Conclusion.—That the diminution of friction by unguents, varies as the insistent weights and natures of the unguents; the lighter the weight the finer and more fluid should be the unguents, and vice versa.

TABLE X.—*Experiments on Velocities in Friction.*

A cast iron Cylinder with two bearings of one inch wide, six inches diameter, with two side collars one-eighth of an inch deep; a rope of three-eighths of an inch diameter wound round the cylinder. Bearing surface $12\frac{1}{2}$ square inches. (See Fig. 1 and 2, page 2.)

Without Oil.

Weight in roller scale.	Wt. required to move the roller.	Height fallen.	Time in falling.	Remarks.	Proportion.
lbs. oz.	lbs. oz.		Seconds.		
348 8	112 0	21 feet.		Four trial experiments made by decreasing weight; very unsteady motion. * Began to grind. † Grinding increasing with stopping.	3.11
300 0	112 0		5		2.67
280 0	114 0		7*		2.45
280 0	114 0		7†		2.45
280 0	228 0		$4\frac{1}{2}$		1.22
224 8	112 0		6		2.00
224 8	112 0		$4\frac{1}{2}$		2.00
174 8	58 0		4		3.00
174 8	58 0		4		3.00
174 8	116 0		2		1.50
174 8	116 0		2		1.50
160 8	56 0		7		2.86
160 8	56 0		8		2.86
66 8	28 0		8		2.37
62 8	22 0		4		2.84
62 8	22 0		4		2.84
62 8	44 0		$2\frac{1}{2}$		1.42
62 8	44 0		$2\frac{1}{2}$		1.42
62 8	44 0		$2\frac{1}{2}$		1.42

Experiments on the Velocities in Friction.

Experiments with Oil.					
Weight in roller scale.	Wt. required to move the roller.	Height fallen.	Time in falling.		Proportion.
lbs. oz.	lbs. oz.		1st half. Seconds.	2d half.	
62 8	7 0		12		8.92
62 8	7 0		17 $\frac{1}{2}$		8.92
62 8	7 0		11	22	8.92
62 8	7 0		9	18	8.92
62 8	7 0		8	16	8.92
62 8	7 0		8	16	8.92
62 8	7 0	21	8 $\frac{1}{2}$	17	8.92
62 8	14 0	feet.	3	5	Found the velocity too great; made an addition of 21 $\frac{1}{2}$ lbs. making $\frac{3}{4}$ cwt. in the fixed scale, which brought it regular.
62 8	14 0		3	5	
62 8	14 0		3	5	
84 0	14 0		3 $\frac{1}{2}$	7	
84 0	14 0		3 $\frac{1}{2}$	7	
84 0	14 0		3 $\frac{1}{2}$	7	This weight produced a regular velocity.
					6.00
					6.00
					6.00
Experiments with Tallow.					
lbs. oz.	lbs. oz.		Seconds.		
272 8	42 0		14	28	6.48
272 8	42 0	21	6 $\frac{1}{2}$	13	6.48
272 8	42 0	feet.	6 $\frac{1}{2}$	13	6.48
272 8	42 0		7 $\frac{1}{2}$	14	6.48

Remarks.

The irregularity of the resistances observed in the first seven experiments arose from the partial contact and consequent grinding or abrading of the surfaces. The roller having attained its bearing, and the weight in the roller-scale being diminished, the irregularity ceased, especially when oil and tallow were used.

From the result of these experiments it will be seen, that friction did not increase with an increase of velocity. The time in falling the whole height of twenty-one feet being double the time in falling half the height. These experiments were likewise illustrated (but not so satisfactorily,) by a machine somewhat similar to that of Mr. Roberts'.—The pulley was sufficiently distant from the roller to render the angle of tension imperceptible.

Appendix to TABLE X.

Friction of the cord and weight on the axles of the iron rollers, to be deducted from the foregoing experiments.		
Weight in each end.	Total of weights.	Weight required to overcome the friction of the cord.
lbs.	lbs.	lbs. oz.
56	112	4 8
112	224	7 0
168	336	11 4
224	448	14 0

Remarks on TABLE X.

The deductions to be made for the rigidity of the cord used in the foregoing experiments under variable weights, as shown in the second and third columns, are nearly as the weights simply, and are applicable to most of the cases in Table IX.

TABLE XI.—*Experiments on the Friction of Ice.*

A block of ice eighteen inches long and two inches thick, as free as possible from air-bubbles, was accurately prepared so as to present a smooth, flat surface, and was then fixed on the frame. A piece of the same block of ice, but of smaller dimensions, was accurately prepared, and made to glide with its flat surface over the bottom block, and a fine flexible silken cord attached to it as in the former experiments.

The weights in the first column indicate the insistent weights, and the weight in the second column the moveable weights. The experiments were made when the temperature of the atmosphere was about 28 degrees of Fahr.

Weight on surface.		Weight required to move it.	Proportion.
Sixteen inches surface.			
lbs.	oz.	lbs. oz.	
1	8	0 3	8.00
4	0	0 5	12.80
16	0	0 10	25.60
36	0	1 0	36.00
64	0	1 6	46.54
81	0	1 13	44.68
144	0	2 9	56.19

Experiments on the Friction of Ice.

Weight on surface.	Weight required to move it.	Proportion.
After remaining 16 hours.		
lbs. oz.	lbs. oz.	
1 8	0 3	8.00
4 0	0 6	10.66
16 0	0 15	17.06
36 0	1 9	23.04
64 0	3 2	20.48
81 0	4 0	20.25
144 0	6 5	22.81
With two skates $4\frac{1}{2}$ inches long, by $\frac{3}{16}$ wide, in surface in each.		
lbs. oz.	lbs. oz.	
1 8	0 1	24.00
4 0	0 3	21.33
16 0	0 7	36.57
36 0	0 15	38.40
64 0	1 2	56.88
81 0	1 10	49.84
144 0	2 1	69.81

Remarks.

From the foregoing experiments it appears, that with ice on ice, friction diminishes with an increase of weight, but does not seem to observe any regular law with regard to that increase.

TABLE XII.—Experiments on the Friction of Hide Leather.

Twelve pieces of hide leather were placed parallel to each other in a wooden box, with one side loose so as to admit of being adjusted according to the number of pieces of leather; a bolt was then passed through the whole, and a nut screwed on the end of the bolt so as to compress the pieces of leather together and permit them to act on edge as one uniform surface; which surface was increased or diminished by putting in or taking out some of the pieces of leather and screwing up the nut as before.

Friction of 9 square inches of Leather soaked in water, moving over a plate of Iron.

7 lbs. barely kept in motion 36 lbs. after starting with the hand. After remaining 5 minutes it took 29 lbs. to start it. 28 lbs. barely

kept in motion 64 lbs. after starting it, and after remaining one minute it took 42 lbs. to start it.

Surface $1\frac{1}{2}$ by 3 inches, equal to $4\frac{1}{2}$ inches area.

$6\frac{1}{2}$ lbs. barely kept in motion 36 lbs. after starting it. After remaining 5 minutes it took 21 lbs. to start it. 21 lbs. barely kept in motion 64 lbs. after starting it. After remaining 5 minutes it took 38 lbs. to start it.

Friction of Hide Leather moving dry over a surface of Cast Iron.

Weight on surface.	Wt. required to move it.	Proportion.	Space passed over	Time.	Weight per inch of area.
Area of surface 9 square inches.					
lbs.	lbs. oz.		inches.	sec.	lbs.
6	1 8	4.0	18	18	.66
7	1 12	4.0			.77
8	2 0	4.0			.88
36	8 12	4.1			4.00
49	12 0	4.0			5.44
64	16 0	4.0			7.11
Area of surface $6\frac{3}{4}$ square inches.					
lbs.	lbs. oz.		inches.	sec.	lbs.
6	1 4	4.80	18	18	.88
7	1 8	4.66			1.03
8	1 12	4.57			1.18
36	7 4	4.96			5.33
49	11 0	4.45			7.25
64	14 0	4.57			9.48
Area of surface $4\frac{1}{2}$ square inches.					
lbs.	lbs. oz.		inches.	sec.	lbs.
6	1 2	5.33	18	18	1.33
7	1 5	5.33			1.55
8	1 9	5.12			1.77
36	7 3	5.00			8.00
49	9 5	5.26			10.88
64	13 10	4.69			14.22

Friction of Hide Leather moving dry over a surface of Cast Iron.

Weight on surface.	Wt. required to move it.	Proportion.	Space passed over	Time.	Weight per inch of area.
Area of surface $2\frac{1}{4}$ square inches.					
lbs.	lbs. oz.		inches.	sec.	lbs.
6	1 1	5.64	18	18	2.66
7	1 3	5.89			3.11
8	1 8	5.33			3.55
36	7 1	5.09			16.00
49	9 1	5.40			21.77
64	13 2	4.87			28.44

Remarks.

The friction of hide leather soaked in water appears to be greatly increased by time and weight. This circumstance explains the enormous friction evinced in the pistons of pumps when first put in motion. When the leather is not soaked, the resistance varies from one $\frac{1}{4}$ th to nearly one $\frac{1}{6}$ th of the pressure, and is diminished (*cæteris paribus*) by a diminution of surface.

TABLE XIII.—*On the Friction of Stones.*

Rondelet found that stones, well dressed, required angles of from 28° to 36° before they commenced gliding.* Perronet observed them to vary from 39° to 40° .† The granite voussoirs of the arches of the New London Bridge having their beds well faced and dressed without mortar, generally commence gliding at angles of from 33° to 34° . But with a bed of fresh and finely ground mortar interposed, the pressure on the centring commences at angles of from 25° to 26° . In other cases of arches where sand stones, such as Bramley Fall and Whitby, were employed, and their beds faced and dressed as usual, the angle of gliding was found to vary from 35° to 36° . But with mortar interposed the angle generally varied from 33° to 34° .

It results from these and other experiments, that friction, by absorbing part of the horizontal thrust, is a most powerful assistant in maintaining the equilibrium of arches, and enables us to determine with something like precision the allowances due to theory.

In general, stones which have a fine grain and uniform texture, and are sonorous and heavy, resist abrasion in proportion to their hardness; and in some experiments of Morisot,‡ granite resists abra-

* L'Art de Batir. Tome iii.

† Mémoire sur le Cintrement et Décintrement des Ponts.

‡ Morisot. Tome iv.

sion twelve times more than lias, whilst the former only possesses a repulsive power three times greater than the latter.

The experiments of Boistard give 0.78 for the friction of hard calcareous stones.*

TABLE XIV.—*On the Friction of Machines.*

1. 21 cwt. suspended at each extremity of a chain (passing over two cast iron sheaves of 2 feet diameter with wrought iron axles, working in brass bearings oiled, and 12 feet 10 inches apart) was disturbed by 3 cwt. or $\frac{1}{14}$ of the total weight. Another double purchased crane indicated $\frac{1}{5}$ th.

2. A double purchased crane having a weight of 7057 lbs. suspended to it indicated 7.62 for the friction. Another double purchased crane indicated $\frac{1}{5}$ th.

In an experiment made on one of the corn mills recently erected for His Majesty's victualling department at Deptford, it required $\frac{1}{10}$ of the weight of the mass to overcome the inertia and friction of the bearings and tangential surfaces. In this instance the pressures of the different parts of the machine varied from 28 lbs. to 8 cwt. per inch area, and the velocities of the surfaces from 50 feet to 120 feet per minute.

Remarks.

It has been customary to deduct one-fourth of the power expended for friction. This allowance may obtain in machines newly set in motion. When the bearings have been equalized and the rubbing surfaces extended by the abrasion of the irregularities, the friction will be diminished and the movements of the machine be more steady. But when the bearings are properly proportioned to the weight of the parts of the machine, and their surfaces kept from contact by unguents, a much less allowance may be made.

Several experiments were made by giving motion to a fly wheel and a grind-stone of known weights and revolutions in a given time, and then counting the revolutions after being detached from the power; but owing to the resistance of the air, and the bearings being too small, the results were unsatisfactory.

TABLE XV.—*Showing the amount of Friction (without Unguents) of different Substances, the insistent Weight being 36lbs. and within the limits of Abrasion of the softest substance.*

	Parts of the whole weight.
Steel on ice.....	69.81
Ice on ice.....	36.00
Hard wood on hard wood.....	7.73

* Recueil d'Experiences et d'Observations, &c.

	Parts of the whole weight.
Brass on wrought iron.....	7.38
Brass on cast iron.....	7.11
Brass on steel.....	7.20
Soft steel on soft steel.....	6.85
Cast iron on steel.....	6.62
Wrought iron on wrought iron.....	6.26
Cast iron on cast iron.....	6.12
Hard brass on cast iron.....	6.00
Cast iron on wrought iron.....	5.87
Brass on brass.....	5.70
Tin on cast iron....	5.59
Tin on wrought iron.....	5.53
Soft steel on wrought iron.....	5.28
Leather on iron.....	4.00
Tin on tin.....	3.78
Granite on granite.....	3.30
Yellow deal on yellow deal.....	2.88
Sand-stone on sand-stone.....	2.75
Woollen cloth on woollen cloth.....	2.30

These results are collected from the different Tables, but the comparison may be made by selecting other values within the limits of abrasion for a minimum.

General Conclusions.

From what has been stated hitherto, it is obvious,—

1st. That the laws which govern the retardation of bodies gliding over each other are as the nature of those bodies.

2nd. That with fibrous substances, such as cloth, &c. friction is increased by surface and time, and diminished by pressure and velocity.

3d. That with harder substances, such as woods, metals, and stones, and within the limits of abrasion, the amount of friction is as the pressure directly, without regard to surface, time, or velocity.

4th. That with dissimilar substances gliding against each other, the measure of friction will be determined by the limit of abrasion of the softer substance.

5th. That friction is greatest with soft, and least with hard substances.

6th. That the diminution of friction by unguents is as the nature of the unguents, without reference to the substances moving over them.

The very soft woods, stones, and metals, approximate to the laws which govern the fibrous substances.

In comparing the present experiments with those of Coulomb, the discordances found to exist relate principally to time. The limited pressures varying from 1 to 45 lbs. per square inch, under which his

experiments were made, account in some degree for the anomaly. But in many of the minor, and in the general results, they will be found to coincide.

The subject might be illustrated still further, by detailing the results of other experiments on the motions of machines, on the friction of solids revolving in fluids, and the descent of carriages down inclined planes. But as the present inquiry principally relates to the friction of attrition of solids, and as the experiments last mentioned have not been sufficiently matured to arrive at the necessary deductions, it only remains to conclude by expressing a hope, that the data now furnished will in some degree enlarge the bounds of our knowledge on this subject; interesting as one of philosophical inquiry, and intimately connected with every branch of the mechanical arts.

*On the Substitution of Plumbago for Oil, in Chronometers. By Mr. L. HERBERT.**

SIR,—Permit me to offer you a few observations upon a subject, which fifteen years of experience have produced; namely, the substitution of plumbago for oil in the rubbing parts of chronometers, in order that they may be laid before the Society of Arts; and thus, if approved, become beneficial to the world at large.

The use of sidereal and mean time pieces in observatories at sea or on land, is to measure the motions of the heavenly bodies, and by them ascertain their right ascension in time, their distance from a given point, and to obtain the longitude of places upon the earth. From that, the word *chronometer* (measurer of time) is derived; but very few deserve that appellation. Whatever may have been the skill of the maker, and the care he took for their perfect construction, the observer must not expect to find them infallible; and however well regulated they were at first, they will not remain so, permanently. Their rate of going will be accelerated or retarded by the temperature of the atmosphere, which causes all metals to expand or contract, more or less, and that in an irregular degree; this will create a variation in their movements; and though innumerable experiments have been tried to render them perfect chronometers, by compensating pendulums or balances that might contravene the atmospheric influence, yet none have been found that would accomplish that desideratum; because it is evidently proved, that metals, after having been acted upon several times by heat and cold, never return to their primitive state at the same temperature.

But, sir, this is not the only difficulty chronometer makers have to combat against; there is another powerful enemy which is always baffling their success, that is, *oil*. The different degrees in the fluidity

* From Vol. XLVI. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce. The Society voted its gold medal to Mr. Herbert for this discovery.

of that liquid, are also great alterants of clock movements. In hot climates it will become absorbed, in cold weather it will congeal, and in both instances impede the freedom of motion. This, nevertheless, may be remedied by a substitute, which I discovered about fifteen years ago; and in order to befriend science, I will here name it, and explain the way of applying it to time-pieces, for the benefit of those who do not mind a little trouble, and have patience enough to go through the process it requires. It is *plumbago*; which, when carefully used, will last a considerable time, without the necessity of being renovated. But much depends upon its quality. It must be of the best kind, free from grit, and the tenderer the better. A spurious sort would endanger the holes and pivots, causing mischief instead of preventing it. The purest I could procure was from the late Mr. Langdon, who was the first pencil-maker in London (perhaps in the world,) Great Russel Street, Bloomsbury; who, after I had explained to him the purpose it was intended for, considered its choice of the utmost importance, and selected some of the best, which answered my utmost expectation. I applied it to my sidereal time-piece, in January, 1816. Since that time, *it has been cleaned three times, without the plumbago being renovated.* The friction places were only wiped over with a fine piece of muslin; and now, in 1827, it goes as well as ever!

I must beg to observe here, that I then found an insurmountable difficulty in charging the jewelled pallets of the escapement with the plumbago; but I obviated that, by applying it to the friction-planes of the teeth of the swing-wheel; and so, ever since, the clock has gone without oil.

The process of preparing and applying the plumbago is as follows:—take about a quarter of a pound of the purest black-lead, the brighter the better; reduce it to a very fine powder, in a metal mortar; and to judge if it is fine enough, take a small pinch of it between the fingers; after rubbing it a few seconds, if it does not feel lumpy and gritty, but smooth and oily, it is good, and ground enough; have then a glass, full of filtered water, take up some of the ground plumbago upon the clean blade of a knife, spread it on the water, and stir it well, cover the glass, and let it stand for two or three hours; upon the top of the water there will swim a kind of film, skim it off with a card, and lay it upon a sheet of paper; when dry, put it into a box, to exclude the dust from it; put the sediment aside. Repeat the process, with some other water and ground plumbago, until you have acquired a sufficient quantity of the fine powder for your purpose. When the whole of the powder is become dry, grind it again in the mortar, or else bruise it with the back of the bowl of a silver spoon upon a clean sheet of paper, and repeat this process two or three times. If the black-lead is pure, no more sediment will go down; but if some does, wash and dry it once or twice more. As soon as no sediment falls, you may be sure that the plumbago powder is pure, and cannot cause any mischief to the pivots and holes. Then pour some alcohol (the strongest spirit of wine) into a small glass, and having previously wiped the pivots of the wheels,

and the holes in the plates, very clean, immerse them first into the alcohol, and then immediately afterwards into the plumbago powder, and they will be covered with it; then take a small brush, or hair pencil, such as is generally used by the miniature painters, dip it into the alcohol, and fill the pivot holes with it; then introduce some of the plumbago powder into them with the finger, by rubbing the plates over the holes, till the powder fills them even with the surfaces; next put in the pivots of the wheels, and make them revolve in the holes in the frame for five or six minutes; do this to the pivots of every wheel, and also repeat it two or three times. The holes and pivots will thus become charged with a thin crust of plumbago, smoother than any polish which can be otherwise given to them; *the time-piece will go twice as long without cleaning as when oil is used*; and, indeed, if its movement be entirely secluded from dust, there will be no occasion for cleaning it for twelve years! After that period the plumbago should be renewed.

The sidereal time-piece, to which I have applied the plumbago, was made with my own hands, and as its rate of going has been astonishingly good, and it is the only one of the construction ever seen, so I will give you a short description of it:—it goes eight days; the movement is not very different from others, except that the swing-wheel is at the bottom, and outside of the plate, supported by a steel cock. The pivot holes of the swing-wheel and the pallets are jewelled. The escapement is fixed upon the pendulum, and swings with it. Its pallets are susceptible of a horizontal and vertical adjustment, by means of three screws; they lock and unlock the wheel of fifteen teeth at the diameter. The vibrations of the pendulum, between the locking and the unlocking, are made in an arc of one degree and ten seconds, as marked upon the index plate; and the full swing is one degree and thirty seconds, making an excess of ten seconds of a degree on each side.

The clock is fixed to a cast-iron plate, fastened on the back of the case, and is adjusted in beat by two screws, acting laterally. The pendulum, which has three bobs, is suspended upon a *potence*, fixed at the back of the case. It has three arms; its perpendicular arm is seven inches long, and rests upon a stud at the bottom even with the pallets; its expansion is upwards, and it acts as a compensation for the length of that part of the pendulum which is between the suspension and the pitching of the pallets into the wheel. Upon the horizontal arm of the *potence*, and over the slit, is a screw-nut, by which the pendulum is hung; it serves to adjust the depth of the pallets in the swing-wheel. The pendulum spring is one inch broad, and its greatest flexibility is at a hole three-quarters of an inch wide; below the spring, at about six inches and a half from its most pliable part, is a plate, to which is affixed the escapement, having a perpendicular slit in the middle, wide enough to admit the cock of the swing-wheel through it, and to let the pendulum vibrate; to this plate is screwed a steel rod, at the end of which slides the pendulum-bob. Above the bob, and from its sliding-piece, branch two arms, with elbows, having a slit at each end, to admit the pivots of

two levers, which support the thermometer-bobs. On the steel rod is a brass tube, whose calibre is just wide enough to admit the rod, and to slide freely over it; this tube is fastened to the rod at its upper end, so that, by its expansion or contraction, it causes the two thermometer-bobs to rise or fall; whilst, at the same time, one acts in a contrary way, and, consequently, produces a compensation. These bobs weigh three pounds each, including one pound of mercury in each of the phials, which are inlaid at the backs of them; they slide laterally upon their respective levers to adjust the compensation. The time-bob weighs five pounds. The clock has no pulley; the weight itself, which is only ten ounces, acting as one. It has even gone with *five ounces only*, during six months! When I had a fixed observatory in Vauxhall Walk, the clock was often proved eight or ten times a day, by the transits of the sun and stars, when the atmosphere admitted; and in the last six months, and after all the improvements I deemed necessary were made, viz. from July 19, to February 24, it never varied above thirty-six-hundredths of a second from its rate!

Such have been the happy results of my experiments; and I have no doubt that such exactness in the going of the time-piece was owing, not only to the correctness of its compensation, but also to the stability of motion produced by the use of the *plumbago*. I am aware that, to those who are averse to employ care and attention, the above process will appear troublesome; but, sir, what is a day's labour once in ten years? Let those, then, whom the love of improvement, and their own reputation stimulate, try it, I am confident that their endeavours will be crowned with success. And with the pleasure of having greatly contributed to the benefit of mankind,

I am, sir, &c. &c.

L. HERBERT,

Geographer at the Colonial Department.

On a new method of Colouring or Ornamenting Steel. By M. LEOPOLD NOBILI, of Reggio, in Italy.

THIS scientific gentleman was recommended to the notice of the Editor by Professor Babbage, in the beginning of the present year, as a philosopher who had much enriched galvanism by his inquiries. He brought with him several beautiful specimens of his new *Métallochromie*, or plates of steel, ornamented with regularly disposed spots, coloured of a greenish-yellow, blue, yellow, and other colours, graduated similarly to bright copper-plates, when exposed to the action of heat. The backs of the steel plates were of a uniform brown colour, thus proving that these beautiful graduated tints had been produced at a degree of heat less than that required to give brightened steel a purple colour.

In the "*Bulletin de la Société d'Encouragement*," for January, 1829, is contained a report, made by M. Gualthier de Claubry, a member of that Society, as follows:

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"A learned foreigner, known by his ingenious researches, M. Leopold Nobili, having presented to this society the results of his experiments relative to a new art, to which he has given the name of *métallochromie*; you charged your committee of the chemical arts to examine these products; and I have, in its name, to report thereon.

"A great number of experiments, more or less successful, have been made by various persons, and at different periods, to apply, in a solid manner, paintings upon metals; but the solidity of the pictures did not equal their wishes, and the thinness of the colours applied rendered their traces vague, and greatly diminished the sharpness and finish of the designs.

"M. Nobili has lately, by his assiduous researches, and the labour of many years, produced, by a process which he has not made known, designs upon various metals, in which the brilliancy of the colours, and the harmony of the tints, leave nothing to be desired; thus these colours possess none of the inconveniences above stated; and they are developed upon the surface of the metals without being too thinly diffused; but are stable, and will not disappear unless by the application of a high red heat, which, by its action, would also destroy the surface of the metal, as well as the chemical agents employed upon it.

"Nothing can be more brilliant and singular than the colours upon M. Nobili's plates, especially by day-light; and all his designs are executed with a fine taste, the regularity of their forms, and the sharpness of their outlines, being all that can be wished.

"M. Nobili has not merely manufactured these plates as objects of curiosity, but has mounted several, which have been singularly esteemed by amateurs; and we can readily believe that this pleasing art would meet with great success were it carried into effect on a proper scale; and it is, therefore, much to be desired that so new and curious an art should not be lost to France, and especially as M. Nobili appears disposed to bring it into practice. We can easily form a just idea of the extent to which it might be possible to carry this branch of manufacture, when we remark that many metals assume their colours in very different orders by the application of heat; and we can easily conceive, that in the hands of a skilful man, and one well conversant with commerce, the greatest advantages might be derived from the employment of this new branch of industry. Thus, for instance, nothing presents more harmony than gold, as its tints are very different from those afforded by heating steel. It is upon this last metal that all the designs presented by M. Nobili have been executed. Silver likewise affords different colours on applying heat; and an experienced artist cannot fail to make many fine applications of M. Nobili's process.

"This process not being exactly known, many persons have accordingly formed suppositions, and even made experiments respecting it; but it does not appear that their suppositions have been well founded; and their success has been much less happy, and their colours less perfectly developed upon the surface of the metal, than

can be effected by an art which has acquired perfection in the hands of M. Nobili.

“Under the impossibility, then, of being able to speak positively as to the manner in which M. Nobili has been able to produce these curious effects, we can only applaud the incessant efforts which he must have made to bring his art into the perfect state in which we find it. All those who have attempted new branches of manufactures, may well conceive the difficulties which every day presents, and which can only be overcome by a continued zeal and efforts to surmount unsuccessful endeavours; and M. Nobili could not otherwise have arrived at the point of perfection to which he has brought his *métallochromie*, nor can he be too much praised for the success he has obtained.

“We again repeat, that it is much to be desired that so curious an art should not be lost to France; and the Committee of Chemical Arts, in order to forward this object, have charged me to propose, that M. Nobili be recompensed for his interesting communication, by inserting this report in the *Bulletin* of the Society.”

On the Manufacture of Coloured Foils.

[Translated from the *Dictionnaire Technologique* for the Technological Repository.]

THESE are employed by being placed underneath the precious, or artificial stones, in order to increase their brilliancy; they likewise serve for decorating works in paper, or pasteboard, and for a thousand other pleasing uses. We may easily perceive that those works are become much more perfect since we have been able to colour the surfaces of these foils, and to preserve the brilliancy of their polish, than when they were merely used in their natural state. The experiments made have been crowned with success, and a new art has been, in consequence, created. The original inventors, indeed, kept their process for tinting the foils a secret; and for a long time it was unknown. This art is now considerably extended, and even improved. As it has not, however, hitherto been described, we shall now endeavour to supply this deficiency.

When we have stated, that we employ varnishes in this manufacture, it is easy to perceive that they must be calculated to serve as coloured varnishes. We first cover the foils, or leaves of metal, with a tint of varnish, and then with another transparent varnish, which may preserve the colours from the attacks of humidity, and likewise contribute, together with the metallic brilliancy of the foils, to produce those fine effects which our customers require. We can vary the processes, according to the tones or shades of the colours; and it is easy to render them deeper or lighter. The following is the ordinary process employed:

First preparation.—We steep, for twenty-four hours, isinglass in very limpid water; and then expose it to the action of boiling water, in a water bath, in order to effect the solution of the gelatine. We

pass the whole through a double linen cloth, or a piece of swan skin, and evaporate it until the solution of gelatine assumes the form of a trembling jelly, after having been placed for two or three hours in a cool cellar.

Second preparation.—We polish the metallic leaves of silver, copper, or brass, which we would colour, and then dip them, one after the other, as we proceed, in a weak *aqua-fortis*, formed of one part of nitric acid, diluted with from eight to ten or twelve parts of water. This immersion cleanses the metal, and renders it of a lively appearance; and *instantly afterwards*, we pass the heated gelatine over it with a hair-pencil, and let it dry, in order to receive any colour we may desire, and which is effected as follows:

Blue.—We put into a small matrass, or an apothecary's phial, an ounce of fine prussiate of iron (prussian blue) reduced to powder, upon which we pour two ounces of hydrochloric acid. The mixture effervesces, and the prussiate is not long in assuming the consistence of a liquid paste. We suffer it to remain twenty-four hours; we then dilute it with nine ounces of water, and preserve the colour thus diluted in a well stopped bottle. This colour is deep; but we can readily lessen its intensity according to our wish, by adding a new quantity of water.

The leaves of silver, or of copper silvered, are better than those of brass, for foils of this colour.

Another Blue.—We take one part of fine Guatemala indigo, and two parts of sulphuric acid, and put them into an apothecary's phial, placed in a sand heat. An effervescence will take place; when this has subsided, we add ten or twelve parts of limpid water to it. This colour, likewise, is sufficiently intense to receive a large addition of water. It may be applied like the preceding, upon silver or copper silvered foils.

Green.—We can prepare this colour in two different ways; namely, either by mixing a decoction of the yellow of Avignon, with a little of either of the blues above described; or by employing a solution of the acetate of copper (distilled verdigris;) these will afford greens of different natures.

Red.—First, we can extract from cochineal a red approaching to purple; and we can vary this red by the addition of more or less water.

Secondly, we obtain another tint of red with a decoction of sandal wood in alcohol, the great volatility of which furnishes a very simple means of concentrating the colouring part more or less. We can also procure another tint by the intermediation of water, which we afterwards evaporate, and thus obtain another extract, after the operation of the alcohol. This last process, is, however, more tedious and expensive.

Thirdly, we can obtain another tint of red, from the *safranum*. We dissolve this colouring material in a solution of crystallized carbonate of soda, precipitate it with citric acid, and suffer it to dry. When it is completely dry, we dissolve it in alcohol. We can extend this colour, in successive layers, upon the metallic plates.

Violet.---We extract the tincture of litmus with alcohol, and thus obtain a deep violet, which we can lighten at pleasure, by a larger quantity of alcohol. This is to be applied in a similar manner to the preceding.

Lilac.---We enclose the litmus in a cloth tied up close, and steep it in water, as long as it will afford a rose colour; we then boil it in a new quantity of water, in which will be diffused the remaining colour; and can apply this decoction, when cold, and diluted to a convenient tint, upon the surfaces of the prepared metallic plates.

Ruby.---We heat carmine, or which is still better, carmine lake, in water; and when the decoction has boiled, we add drops of liquid ammonia to it. We suffer the liquid to settle, in the cold, and then pass it over the metallic plates, without filtering it.

Rose.---There are many ways of procuring rose colours.

First, we add to the *ruby* colour a sufficient quantity of water to reduce it to the tint we desire.

Secondly, the *safranum* affords, by diluting its colour, rose colours of various tints.

Thirdly, a decoction of Brazil wood, revived by the addition of a solution of tin in the hydrochloro-nitric acid, affords various tints of rose colour.

Scarlet or Poppy colours.---We first spread, for the poppy colour, a layer of the *ruby* colour, and over this, a second coat of the tincture of the oriental *safranum*, extracted by macerating it in cold water for forty-eight hours.

The *Capucine*, the *Aurora*, the *Jonquille*, and certain other yellow colours, may also be obtained by treating the oriental *safranum* in the above manner, and which will afford colours more or less deep.

Plumb or other Browns.---Apply a coat of lilac colour, and over that another of green or blue.

General observations.---We must never apply a second or third coat of colour, until the preceding ones shall have become perfectly dry. We must always avoid passing many times over the same spot, as the new layer, however cold, disturbs the preceding ones. And thus it is always advantageous to give the colour bath a tint sufficiently deep, in order to dispense with the necessity of passing it repeatedly over the surfaces.

These various tints, however, do not yet possess the solidity they ought to have, as they may easily be removed by the effect of rain, or even of a mist; and can only be preserved from their action, by covering them with a defensive varnish. That which has generally been applied to this kind of manufacture, is the *white alcoholic drying varnish*. But, if we would add to the solidity and better preservation of the tints, we should use *white copal varnish*. As this last, however, continues to diffuse a slight odour for some time, so we may cover it with a layer of the *white alcoholic varnish*. This species of manufacture, however, does not require a great degree of solidity to be given to it.

On the Employment of Iodine, and a Triple Acetate of Lime and Copper, in Dying, &c.

From the *Bulletin d'Encouragement*, 1828.

It appears, from a note by Pelletier, that he ascertained, during a recent visit to England, that a large quantity of perioduret of mercury is sold in that country under the name of *English vermillion*, which is employed, principally, in the preparation of paper hangings. Learning, also, that iodine was used in calico printing, he analysed a specimen of the colouring material from Glasgow, and succeeded in forming a compound, which was a perfect imitation of the English one. The proportions which he found to succeed best, were the following:

Hydriodate of potash,	-	-	-	-	-	65
Iodate of potash,	-	-	-	-	-	2
Ioduret of mercury,	-	-	-	-	-	33

This salt appeared to have cost, in England, one hundred francs the kilogramme (2 lbs. 3 oz. ;) but could be prepared in France for thirty-six francs.

"It appears to me (observes this skilful chemist,) that this salt ought to be applied to the cloth before it is passed through metallic solutions. Among the latter, those which give the most beautiful colours, are the solutions of lead and mercury. This salt may be applied with advantage to cloths, by the aid of a solution of starch, which becomes of a beautiful violet colour (a known effect of iodine and starch.) The starch appears also to contribute to fix the salt on the cloth.

"There is another salt also much employed, it is said, in Glasgow, in calico printing, which I ought also to mention, because it appears not to be much used in France. This is a triple acetate of lime and copper, prepared in the large way, by Ramsay, of Glasgow, for the printers. This salt is of a very beautiful blue colour. It crystallizes in prisms, with square bases. The summits of the prisms are, however, often replaced by facets, whence result prisms with six or eight planes, according to the extension which the secondary faces acquire.

"When this salt is decomposed by a fixed alkali, the oxide of copper and the lime are precipitated combined, because they meet in the nascent state, and in definite proportions. It is certain that the precipitate turns but little green in the air, even in drying; and in its application it is a kind of verditer, which becomes fixed on the cloth. I call the attention of calico printers to this salt, which may furnish very beautiful dyes, and cannot be very expensive."

On the Preparation of Crayons, or Pastels.

[Translated from the *Dictionnaire Technologique* for the Technological Repository.]

CRAYONS are coloured pastes which artists use in making drawings, to which they give the name of "drawings in pastel." The best crayons come from Switzerland, and principally from Lausanne.

As they cannot, in this species of dry painting, produce the different colours or shades necessary, by mixing the principal colours, or diluting them with white, as in other kinds of painting, they are obliged to have crayons of all colours and shades.

This kind of crayon results from the mixture of any colour with a colourless base, and the whole has the consistence of a soft paste given to it, by means of a weak mucilage. This paste is afterwards formed into small cylinders, and dried; but as it is indispensable that the crayons should readily extend upon the paper, and apply themselves in a smooth uniform layer, without any grittiness, so it results, that we cannot indifferently employ, for making them, every kind of colour, basis, or mucilage; as there are some colours which, in drying, acquire too great a degree of hardness, and which they communicate to all the crayons of which they should form a part; and there are others which are susceptible of becoming more coherent with one vehicle than with another. It is the same with the mucilages also, which might give too great a degree of hardness to one kind of paste, and too little to others. And we have, therefore, to make choice between them, and to vary their proportions, in order to form crayons which should possess all the requisite qualities.

We have before mentioned, that it is particularly necessary that the crayons should readily extend upon the paper, and in uniform layers; but these conditions cannot be fulfilled, unless the particles composing the paste be exceedingly minute, and be held but slightly together. And thus, the best means of separating the molecules, and giving them the requisite degree of minuteness, is by employing the method known by the term *levigation*; and which consists in adding to the bodies, previously reduced to a fine powder, a considerable quantity of water, and stirring the whole until it forms a uniform mixture; this must be suffered to remain a few moments at rest, and then be poured off. This will at length deposit, as we can readily conceive, a powder, which is much more subtle than the former one. In fact, as the molecules are larger, so they are heavier, and precipitate in much less time than the former or smaller ones. This method of proceeding equally applies to all the bases, as well as the colours. After this statement, we must add, that the most usual bases or excipients of the colours of crayons, are either washed chalk, or the white or tobacco-pipe clay; sometimes, indeed, but rarely, we also employ calcined gypsum, the oxide of bismuth, the sub-carbonate of lead, or ceruse, and also starch or flour. It is to be presumed, that the magnesian earths, which are ordinarily so soft to the touch, also offer some advantages in this respect; the solar earths, and the ochres, which are nothing else than clays naturally coloured by the oxides of iron, may also be usefully employed in the preparation of crayons.

When we have selected that base which is most convenient to mix with the colour that we would employ, we must also seek for that species of mucilage to which we ought to give the preference; in order that the crayons, after being dried, should preserve the necessary degree of consistence; and here the only sure guide is experi-

ence; that is to say, we must make trials on a small scale, when we first begin to form this kind of composition. Thus, to bind these pastes, we usually employ the mucilage of gum arabic, or still better, that of gum tragacanth; but we must also make the mucilage more or less thick, according to our design; that is to say, we must dissolve in the same quantity of water more or less gum. In general, the preference is given to gum tragacanth, because an equal weight of it furnishes a more abundant mucilage, and, consequently, there remains a less weight of it in the paste after dessiccation.

When the pastes require but a slight degree of agglutination, we add to the mucilage of the gum a little sugar, in order that it may acquire a less degree of hardness in drying; or we may substitute for the mucilage, either a simple decoction of malt, or milk. Sometimes, also, the addition of a little soap-lees produces a good effect. Finally, we also incorporate, with certain pastes, and principally those in which alumine forms a part, fatty bodies, such as oils, wax, or suet; and we even entirely replace the mucilages, or other viscous materials, by a mixture composed of sixteen parts of suet, four parts of wax, and one part of spermaceti. But we can only use these crayons upon canvass, or pasteboard, coated with oil varnish, and dusted over either with powdered glass, or pumice stone in powder; they are, indeed, more difficult to use, but then the pictures produced have more solidity than those made with the ordinary crayons.

After giving these general details, it now remains that we indicate the processes for the preparation of crayons or pastels. We commence by making what are termed the primitive pastes, and which are afterwards mixed with other ingredients in different proportions, in order to obtain all the required shades of colour. Thus, we grind in the usual manner, the colour which is to enter into the paste; we then add, by grinding, a sufficient quantity of the base, or excipient, to form a shade which may serve as a type or pattern, we then divide this into as many portions as we would obtain other shades, and incorporate with each, a progressively increasing quantity of the white base, or excipient. Thus, in the first portion we put, for instance, one part; in the second, two parts, &c., until we have formed all the gradations of tint we require. We may readily conceive, that this method equally applies to other colours mixed with the primitive ones, and that it is easy, by this means, to obtain from them all, every colour, and of every requisite gradation.

It is easy to perceive that it would be inconvenient to dispose of a great number of these pastes at once, especially in summer, as the masses would dry at their surfaces, before they were formed into crayons, and thus produce lumps, which would mix but difficultly with the remainder of the paste, and thus render it gravelly. Supposing, then, that we have only prepared a certain number, and that we would form them into crayons; we commence by drying the paste a little, between doubled unsized papers, and when the excess of humidity is thus absorbed, and the paste can be handled without adhering too much to the fingers, we divide it into small masses, which we first form into balls between the palms of the hands, and then

roll them between the flat part of the right hand, with a backward and forward motion upon a well dressed, flat and smooth, wooden plank, upon which are also affixed two small parallel rods or bars of an equal thickness, and which are placed at right angles to the workman. The paste is thus formed into long cylinders, and when they begin to be of a diameter nearly equal to the thickness of the bars, in order to reduce them to the required thickness, we substitute a piece of flat and smooth wood for the hand, and whose length exceeds that of the width between the two rods, and is gradually tapered away at each end, so as to form handles. We continue this backward and forward movement until the piece of wood rests at each end upon the two rods. The cylinders thus acquire length, and it then only remains to divide them, by means of a knife, into the lengths which we would give to them. They are usually about two inches long. In order to cut them without flattening their ends, we should take care to apply the knife, whilst rolling the cylinders.

When we have taken care to press the paste well in rolling it, in order to drive out any particles of air which it enclosed, we shall obtain crayons which will break with a homogenous fracture; but if, on the contrary, we have neglected to take this precaution, they will be too fragile, and their fracture will be cavernous. In this case it will be difficult to use them upon paper, and we think that in order to obviate this inconvenience, and without being obliged to have recourse to a manipulation much longer than this we have described, the rolled paste might be strongly compressed between two channels which exactly correspond, and thus form a cylinder of the exact dimension we would give to the crayon. Others, on the contrary, employ a mandrel formed of polished brass, from eight to ten inches long, and slightly conical. They roll upon this mandrel a thin leaf of tin (tin foil,) and then take it off the mandrel; into this kind of mould they pour the paste, made a little more liquid than in the preceding case, and then leave it to dry slowly. When the crayon has become of a certain consistence, they remove the tin mould.

Amongst the crayons usually sold, and which we submitted to trial, we laid aside those which were not of a proper quality; that is to say, those which were either too hard, or too fragile. We remedied the first fault, and which is usually occasioned by their containing too large a proportion of plaster of Paris, by again grinding up the crayon with a little milk and water, and then proceeding in the manner above indicated. And we obviated the second defect, which evidently proved the want of a binder, by adding a little to them thus; we ground them up with a sufficient quantity of water, and then incorporated more or less clay with them, as was required.

We are obliged to take great care in avoiding the breaking of the crayons. Generally they are contained in flat boxes, where they are disposed in parallel rows upon cotton. Each colour, and its gradations, occupy distinct places, for the facility of using them.*

* We have before mentioned, that we sometimes employ fatty substances in making certain kinds of pastels or crayons. We find in an old Dictionary of

We think that what we have above stated, might be sufficient to guide those who have a sufficient knowledge of colours, and of their preparation; nevertheless, we shall add thereto a certain number of receipts, or at least indications, which we find in the *Traité des Couleurs*, by M. I.—Ch. Leuchs.

White Crayons.

“1st. Pure chalk, well washed without any other preparation.

“2nd. White lead (*ceruse*) ground with milk, and dried in the shade; if they should not possess sufficient solidity, a little gum may be added to the milk.

“3d. The white oxide of zinc, treated in the same manner. Or we may also use the sulphate of barytes, magnesia, or calcined bones.”

We may observe with respect to the white from zinc, that it possesses a great advantage in not becoming black, as is the case with white lead, by exposure to sulphureous vapours. We can employ that oxide of zinc, which is known in commerce by the name of flowers of zinc; but, as it likewise always contains some grains of metal, so it is essential to commence by separating them, by mixing it with water, and passing it through a sieve, placed over an earthen vessel; the oxide passes through the sieve, but the grains of metal are retained in it.

The sulphate of barytes is of too dry a nature to make good crayons. The calcined bones, which are, as we know, entirely composed of phosphate of lime, are likewise in the same predicament, though in a less degree; but it is possible to give this salt a different preparation, which renders it much more applicable to this purpose. We treat the calcined bones by the sulphuric acid, as in the process for making phosphorus; we then saturate the acid phosphate of lime,

the Arts, the following receipts. The first is due to a German painter, named Reifftein; it consists in first reducing the colours, by grinding, to a very fine powder, and then incorporating this powder with a mixture of wax and suet. This mixture is to be ground up in a small vessel, exposed to a very gentle heat. When the mixture is become nearly cold, it must be cut into small portions, which are to be placed between double blotting paper, in order to absorb the excess of fat in the crayons, and thus to give them a consistence, when they are to be thrown into cold water. These crayons, as we before observed, can scarcely be used upon common paper.

We also find another receipt, given by a painter named Bachelier, who had found the means of preparing two kinds of crayons; the one soft and tender, so as to be capable of extending between the fingers, and which might be fixed, by exposing the drawing made with them to a slight degree of heat, as is practised with the paintings in encaustic. He was not so sanguine as to the durability of the drawings made with the others. To prepare the first kind, he dissolved salt of tartar in warm water, to saturation; he then filtered it through paper, placed it over a gentle fire, and dissolved white wax in it; the result was, a kind of soap of wax, of the consistence of boullie, and very soluble in water. When he would prepare crayons, he dissolved a little of this kind, and used the solution to incorporate with the colours, and make a paste, which he cut and formed into small pastels, proper to make fixed drawings by afterwards heating them. To make them harder, he placed them under a muffle, and gave them a small degree of heat. We might make coloured drawings with these crayons, which, according to the assertion of this artist, would not alter.

which we obtain by lixiviation, by means of the sub-carbonate of soda, which remains in solution; and the sub-phosphate of lime, which, being insoluble, is precipitated. We then wash it well with a large quantity of water, filter it, and obtain this new phosphate of lime, which no longer possesses the rigidity of the bones, but, on the contrary, has a great tenuity, and is of a fine dead white colour.* A slight calcination renders this white still more clear; but we must take care that the washing has been perfectly performed, otherwise, if any phosphate of soda remains in it, it will form a kind of *frit* of great hardness.

Yellow Crayons.

“1st. Natural ochre, ground up with more or less gum water, and formed into crayons.

“2nd. Mineral yellow, Naples yellow, chrome yellow, or turbith mineral, either ground separately or with chalk, and gum water, and put into form.

“3d. Orange arsenic, treated in a similar manner. These crayons must not be employed with those made of white lead.”

We can also obtain fine shades of yellow, by mixing, in various proportions, a solution of alum with solutions of iron, at different degrees of oxidation; then precipitating the whole by the sub-carbonate of soda, washing the precipitate, and either simply drying it, or submitting it to a calcination more or less great.

It is to be regretted that the *sulphuret of cadmium* is so dear, as it is not only of a fine yellow colour, but, which is of more consequence, it is not, like the above, likely to change from exposure to vapours.

Red Crayons.

“1st. Soft red chalk, red earth, or bole, either ground up with milk or gum water.

“2nd. Vermillion, brown red, chrome red, either singly, or mixed with white earths; and rendered solid by gum tragacanth.

“3d. Lakes of Brazil wood, madder, or carmine, mixed with clay, and sometimes with starch; and rendered solid with the yest of beer, milk, or gum water.

Blue Crayons.

“1st. Prussian blue, or indigo, ground with the decoction of malt.

“2nd. Smalt, or cobalt blue, either singly or with chalk, and ground up with gum tragacanth water.

Green Crayons.

“1st. Green earth and chalk, ground up with gum water.

“2nd. Brunswick green, or any other green colour from copper, ground up with gum water.

“3d. Yellow and blue mixed.

* Surely this preparation must form an excellent white colour for miniature painting.—EDITOR.

Brown Crayons.

“Umber, single, or ground up with chalk and gum water.

Black Crayons.

“1st. Willow charcoal.

“2nd. Lamp-black calcined, with a little umber, indigo, and gum, or the decoction of malt.”

We are obliged to M. Ferrand for communicating the following receipts, which he has put in practice with success, in his colour manufactory at Paris.

Blue Crayons.

As Prussian blue acquires too great a degree of hardness in drying, we can obviate this inconvenience in the following manner. We treat the Prussian blue, by heating it in concentrated sulphuric acid, and then adding a large quantity of water; the blue, which at first disappeared, is then reproduced, but in a perfect state of division. We suffer it to precipitate, and wash it well in several waters; then we add to the blue, in the state of a *bouillie*, a mixture of equal parts of chalk and magnesia, both of which had previously been properly prepared; and, finally, we wash it again once or twice, in order to remove a little sulphate of magnesia, which forms itself, as well as all the acid, which was not before entirely freed from it. We then drain it and dry it, and finally grind it up with a sufficient quantity of water to make a paste, which we form into rolls or cylinders, without adding any gum.

Red Crayons.

The carmine lakes, which contain much alumine, are subject to the same inconvenience as the Prussian blue; that is, they make crayons which are not soft enough. We obviate this defect in the following manner. We tinge with red the chalk of Champagne, mixed with a fourth part of magnesia; in order to do this, we employ cochineal, which we boil with a little alum; we then put this decoction, after straining it, into an earthen vessel; the alum is decomposed, and the alumine, on separating, entangles with it the colouring matter, and the liquor is found colourless. We repeat this process until the chalk is become sufficiently tinged, then dry it, and mould it in the usual manner.

R.

On an Apparatus for Evaporating Sirops.

[From Ferussac's *Bulletin des Sciences Technologiques*.]

“THIS apparatus, which has been recently established in France, and for which the inventor has obtained a brevet, is chiefly remarkable for its great simplicity. A copper boiler, hermetically closed, and some wooden vessels, in fact, compose the chief part of the apparatus. The vacuum is made by steam, and the steam is afterwards condensed by cold water, so simple is the process. The apparatus

does not require the employment of any pump, nor of any other auxiliary machine, as it performs its functions without motion. And thus, not only is the vacuum produced and preserved without the aid of the pneumatic pumps, which are employed in Howard's English apparatus, but the water necessary for the condensation, rises of its own accord into the reservoir destined to receive it, and which is elevated from eight to ten feet above the surface of the earth. The management of the apparatus is also much less complicated than that of Howard; and thus a workman possessed of the least degree of intelligence can govern it; in fact, it is reduced merely to the turning of a few cocks! The steam is also produced under the ordinary pressure, which removes all idea of danger. The proofs are taken by drawing out the boiled sugar into threads, as usual; and an instrument is applied to the boiler, which permits us to extract a small portion of the sugar from time to time, and without suffering the air to enter the boiler. This instrument differs entirely from that used in Howard's process, it is not only more simple, but is also more convenient.

M. Leclerc, a manufacturer of sugar from the beet root, is the first person in France, who has adopted this new apparatus at his sugar refinery, near Péronne. He employs the steam produced from a covered boiler, in which the juice is concentrated before it is clarified. This boiler thus serves as a steam generator. The steam thus produced heats the boiler (the vacuum pan of Howard's apparatus) in which the sirop is brought into a state of ebullition. The withdrawing of the atmospheric pressure from its interior, permits us to obtain this ebullition without heating the steam to more than eighty degrees of Reaumur's thermometer. The sugar boiling is thus effected at a temperature of from fifty to sixty degrees. It depends upon the workman to regulate this internal heat, and which he can raise or lower at will. Experience has, however, proved, that it is necessary to elevate it to sixty-eight degrees towards the end of the boiling, in order to give the sirop the temperature necessary to produce a good crystallization of the sugar. This effect, however, is still obtained, without suffering the air to enter, or injuring the vacuum. The internal pressure is indicated by a mercurial gauge, which varies in its range, according to the density which the steam has acquired. The exclusion of the air is perfect, and the vacuum is maintained without being perceptibly weakened during the whole course of operation, prolonged, as we see, many hours. Whereas, in order to produce a vacuum in Howard's apparatus, pumps are required, which must possess a degree of perfection difficult to give them. M. Roth's apparatus is capable of being established upon any scale which may be required, and in all localities. The want of water need be no obstacle. Firstly, the quantity required, is much less than that which is employed in the English sugar refineries, it is about a fourth part only; three litres and a half of water being required for each litre of sirop. And, secondly, it is possible, and even advantageous, not to replace that which has served for the condensation. On leaving the apparatus, it has acquired a temperature

of from forty to forty-five degrees; and it is received into a reservoir, placed outside of the buildings. After arriving at this reservoir, its surface is not long in cooling. The tube of aspiration, intended to elevate it again to the apparatus, takes it from the bottom of the reservoir; this alternate motion of rising and falling, may be continued, with the same mass of water, for a longer or a shorter time; nay, it may be prolonged indefinitely, provided the water is not suffered to become putrid. This inconvenience may be avoided by saturating it with lime.

The vacuum pan, in M. Roth's apparatus, evaporates from an equal surface, with much greater speed than an open boiler, placed over an open fire. When established upon a proper manufacturing scale, one pan will boil nearly 4000 litres of sirop daily.

We can believe, after what has been above stated, that the expense of establishing this apparatus cannot be great. According to report, it is beyond all comparison, in this respect, with that of Howard. Its construction is solid and simple, and the absence of all friction renders the keeping of it in repair easy, and, of course, at but little expense.

The advantages which it presents, are, first, to produce an economy in the heating; secondly, the boiling the sirops without weakening them, and thus affording better and more beautiful products; thirdly, making more sugar, and less molasses (about ten per cent.); fourthly, shortening the time of claying the sugar; fifthly, causing the inconvenient and noxious vapours usually produced from sugar refineries to disappear; and, lastly, to procure a great quantity of hot water, applicable to various purposes.

Remarks by the Editor of the Technological Repository.—Our readers will find two of the late Mr. Edward Howard's patents for sugar refining, in our *Technical Repository*; and Mr. Barry has a patent for evaporating sirops, &c. in a vacuum, produced much in the above manner. We greatly doubt the success of M. Roth's apparatus; but if it should prove to be capable of producing the effects stated, and in so simple and facile a manner, it will produce a wonderful alteration in the present system of sugar refining. We believe that the use of Mr. Howard's excellent, but expensive apparatus, is not now extending here, although we know that it has been lately adopted at Vienna.

On Preparations for Dying the Human Hair. By M. GENDRIN, M. D.

[From "*L'Indust.*" or *Revue des Pays Bas.* 1829.]

THE formulas of the preparations for dying hair are numerous; they may, nevertheless, be reduced, with respect to their mode of action, into two classes: the first, comprehends all those by which iron is caused to penetrate the hair in a determinate proportion, and which is afterwards changed black by the action of gall nuts. The

second comprises those formulas in which sulphur is employed, and made to penetrate the hair; and being afterwards susceptible of becoming black by combination with those substances which are black in the state of sulphurets.

To the first kind belongs the following formula, which is given by Forestus.

Take red wine, one *livre*;
 muriate of soda, one *gros*;
 sulphate of iron, two *gros*;

Boil them for some minutes, and then add,
 oxide of copper, one *gros*.

Make them boil for two minutes, withdraw them from the fire, and add,
 pulverized gall nuts, two *gros*.

The hair and beard must be well rubbed over with this composition, and some moments afterwards with a warmed linen cloth, and then be washed with common water.

The following formulas are of the second species:

Take oxide of lead, two parts;
 slaked lime, one part;
 chalk, two parts.

Mix them with water, and dip a hair-pencil or brush into the preparation, with which the hair must be well rubbed; and at the end of two hours it must be washed, and the effect will be produced.

This last formula is the most generally employed, and is exempt from any inconvenience. Notwithstanding all that has been published against the practice of dying the hair, yet a great number of persons have recourse to it, and without experiencing the least accident. In this preparation there is produced a black sulphuret of lead, which is combined with the hair. The lime, when diluted by the chalk, loses that causticity which rendered it noxious.

We likewise frequently employ the following preparation, which is more active.

Take quick-lime, in the stone, one *livre*;
 yellow litharge;
 white lead, of each one ounce.

Dissolve the lime in water, and add, by degrees, and constantly stirring all the while, the oxides of lead.

There likewise belongs to these kinds of preparations, another, but which possesses serious inconveniences: this is a mixture of lime and nitrate of silver. This mixture, which, indeed, blackens the hair, nevertheless produces an erysipelas on the skin, in which the hair is implanted; and its use ought, therefore, to be prohibited.

Description of a Safety Chair for Glazing, Painting, or Cleaning Windows. By WILLIAM BADDELEY, jun.

A GREAT number of distressing accidents frequently occur in various parts of the metropolis, by persons being precipitated into the

street while cleaning the outside of windows, &c. Nor is the occurrence of these accidents confined to servants, who imprudently venture to sit, and sometimes even to stand, on the exterior of the window sill; for glaziers find, to their cost, that continual employment in this avocation is not at all times sufficient to ensure their safety. A short time since, one of these men fell from a window, and was impaled upon the iron railings of a house in my own neighbourhood, from whence he was extricated with considerable difficulty, sadly torn and mangled. After lingering a few hours, in the most deplorable condition, death terminated his sufferings. It is to be regretted that this is only one of a great number of melancholy instances, which show the necessity of employing some means or other to remove the great risk attending the cleaning or painting the exterior parts of a building.

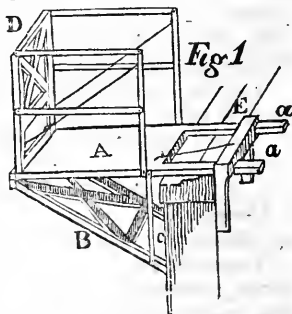
Various machines have, from time to time, been constructed, to prevent a recurrence of accident,—several of them of considerable ingenuity; but most of them were cumbersome, and caused so much damage to walls, &c. in being carried up and down stair cases, narrow passages, &c., that they soon fell into disrepute.

A “Portable Balcony, or Domestic Life Preserver,” has been invented by Mr. Gregory, whose active exertions in the cause of humanity (both in the present instance, and also in the great attention he has paid to the means of providing escape from fire) entitle him to the gratitude of society. The machine of Mr. Gregory is by far the most convenient for this purpose that has hitherto been constructed. It allows the most timid female to stand on the outside of any window, with the most perfect security; and is, for glaziers’ use, far preferable to the machine usually employed by them.

One of these machines may be seen in the National Repository; and, perhaps, the following sketch, from memory, will give your readers a tolerably correct idea of its construction:—

On the under side of a flat board, or platform, A, (Fig. 1,) is fixed by hinges, a frame with two legs, B, also connected, near the extremity, with the platform, by double joint irons, c. A back, D, with one vertical and two horizontal side rails, is also jointed to the upper side of the platform. By thus connecting its several parts together by centerings, the machine is capable of assuming a very portable form,—the whole folding together quite flat (as shown in Fig. 2;) in which state it can be carried about with the greatest facility, and without injuring the narrowest staircases or passages.

In using this machine, the legs, B, are first separated, to their full extent, from the machine, (as in Fig. 1,) and are placed upon the outside of the window. Two arms, a a, project from the platform



to a short distance within the room. Upon these arms a small frame, E, having two legs, slides; and when brought close up to the inside of the window, is secured there, either by pins, or, what is more generally preferred, by a cord, which passes from the top of the frame, and is wound round a hook near the middle of the platform. The back and side rails are then raised, and are retained in the elevated position by an iron rod and hook on each side, proceeding from the lower part of the back, and fitting into an eye on the upper part of each of the side rails, forming a strong diagonal bracing.

It is needless for me to enlarge upon the merits of this contrivance, as they must appear self-evident to every one, on its first inspection. It has already met with extensive patronage, both in private families and public establishments, as well as from several intelligent glaziers, who have adopted it in lieu of the unsafe machine hitherto employed. Certain I am, it only requires to be better known, to be yet more extensively employed. The price is two guineas; and when the numberless occasions on which it is required are taken into consideration, the expense is trifling, compared with the solid advantages to be obtained by its adoption. [Mechanic's Magazine.]

FRANKLIN INSTITUTE.

The Twenty-fourth Quarterly, or Sixth Annual Meeting of the Institute, was held at their Hall, on Thursday evening, January 21, 1830.

JAMES RONALDSON, President, in the chair.

WILLIAM HAMILTON was appointed Recording Secretary, *pro tem*.

The minutes of the last quarterly, and also of the meeting held this afternoon to appoint tellers, and to open the poll for the election of officers and managers for the ensuing year, were read and approved.

The annual report of the board of managers, and also of the treasurer, were severally presented and read, whereupon it was Resolved, that the reports be accepted, and that the report of the board of managers be referred to the committee on publications, to publish so much thereof as they may deem expedient, together with the minutes of this meeting.

The tellers appointed to receive the votes of the members for the officers and managers of the Institute for the ensuing year, presented their report to the president, who declared the following gentlemen duly elected:

JAMES RONALDSON, *President*.

ISAIAH LUKENS, } *Vice Presidents.*
THOMAS FLETCHER, }

ISAAC B. GARRIGUES, *Recording Secretary*.

ISAAC HAYS, M. D. *Corresponding Secretary*.

FREDERICK FRALEY, *Treasurer*.

Managers.

Samuel V. Merrick,
 Abraham Miller,
 Adam Ramage,
 Ashbel G. Ralston,
 Rufus Tyler,
 John Struthers,
 John O'Neill,
 Matthias W. Baldwin,
 Joseph H. Schreiner,
 Samuel J. Robbins,
 Henry Horn,
 Mordecai D. Lewis,

Charles H. White,
 George Fox,
 Andrew Young,
 Christian Gobrecht,
 Thomas Scattergood,
 Thos. M'Euen, M. D.
 Thomas Loud,
 James Rowland, jr.
 Benjamin Reeves,
 Thomas U. Walter,
 James M. Bolton,
 Charles H. Kirk,

On motion, adjourned.

JAMES RONALDSON, *President.*

WILLIAM HAMILTON, *Recording Secretary, pro tem.*

Sixth Annual Report of the Board of Managers of the Franklin Institute.

To the Franklin Institute of the state of Pennsylvania, for the Promotion of the Mechanic Arts, the Board of Managers make the twenty-fourth quarterly report.

AT the conclusion of another year, the board of managers in sur-rendering the trust which has been committed to them, in compliance with the requirements of the constitution, present to the members of the Institute a view of its transactions. It is gratifying to observe, that the operations of each succeeding year contribute more fully to establish the character and extend the influence of the institution. The objects for which it was established being now well understood, and, consequently, justly appreciated, all that is required to give permanency to the institution, is the fostering aid of the community, which the board entertain the most confident hopes will not be withheld.

From the committee on instruction, the board have received, from time to time, detailed reports on the various subjects embraced within their jurisdiction. In the month of August last, the High School ceased to be under the control of this committee, having completed the term of three years, for which it was originally established. The board are duly sensible of its merit, and public utility, and do not doubt, that, under its present organization, it will continue to be the means of the diffusion of education, upon terms so moderate, as to place it within the reach of all who desire to avail themselves of so valuable a privilege.

The regulations for admission to the lectures, have been attended with the most beneficial results, and the attendance during the present season, has been much greater than on any of the preceding ones. Every exertion has been made by the Professors to explain and illustrate their several departments of science, and from the in-

terest which has been excited, it is believed their efforts have been successful.

The board are under great obligations to Peter A. Brown, Esq. for his course of volunteer lectures on geology, during the present season. Arrangements have been made for the delivery of volunteer lectures during the remainder of the term.

The drawing school has excited a degree of interest which is unexampled, and its numbers have increased so rapidly, as to prevent the admission of several applicants. It is to be hoped that this interest will continue, and that apprentices and others will duly appreciate the advantages of this school. The board regret that the operations of the mathematical school have been altogether suspended, by the continued illness of the instructor, Mr. Levi Fletcher.

The flattering prospects held out in the last report, in relation to the Journal of the Institute, have not been fully realized. Considerable exertions have been made by the editor, and the publishing committee, to render it a more original work, but as yet, they have met with but partial success; nor can they hope completely to effect their object without a more general co-operation of the members of the Institute. There are many well qualified to give aid, by contributing observations on their daily practice, which would increase the interest and utility of the work. The board beg leave again to call the attention of the members to this department of their labours, under the hope that it will meet that attention, which, from its importance to the arts, and to the well being of the institution, the subject deserves.

The interest taken in the Journal by subscribers, has been greatly increased by the analysis of patents, which has occupied a large portion of it during the past year.

To those whose attention is called to the construction of new machinery—the knowledge of what has been done or attempted by others, is of incalculable value; and to them a work giving a description of all new inventions, as they appear, must be an acceptable offering. The board deem the policy of giving publicity to patents, too evident to need an argument.

The plans and improvements laid before the committee on inventions, during the past year, have been more numerous than heretofore; several of them have been deemed useful and valuable, and have been reported on, favourably. The reports, in many cases, have already been presented to the monthly meeting; others, being on incipient inventions, have from necessity been retained by the committee; their rule having been not to make public any report which is unfavourable, nor to make an invention known without the consent of the inventor, excepting where the invention has been referred to them by the monthly meeting.

How far their decisions have been deemed just by the projectors, the board are unable to say, but it may be fairly inferred from the increased number of the applicants, that the confidence of the public in the judgment of the Institute, is undiminished.

Your board would beg leave to call the attention of the Institute to the cabinet of models. Since the first year of our institution, no additions have been made by purchase. The limited amount of funds within the control of the board has prevented them from appropriating any to this use, excepting for such models as were absolutely necessary, at that time, for the lectures. Nor do they see any prospect of increased means for promoting this object. This interesting department must, therefore, depend on private donations for its support. Hundreds of models are, probably, in existence in this city, of little service to their owners, which, if collected, would be of great value for reference. If it be thought too much to ask the donation of a valuable model, it would be of great service to the arts to make the Hall of the Institute the place for their deposit. The board feel assured that if an example were set by some public spirited individual, it would soon be followed, and the Hall of the Institute become a valuable depository of the works of art.

The board with pleasure recur to the flourishing state of the library. Like the model collection, it had languished unaided by the funds of the Institute; but of late a spirit of liberality has been manifested towards this department, by the members, and others, and many valuable additions have been made. The cases allotted for it are nearly full, and if this spirit is maintained, the board anticipate soon having to make further arrangements for its accommodation, and a hope may confidently be entertained that it will, at an early period, be made more available to the Institute, and afford increased means of diffusing information.

The cabinet of minerals, though not of such general interest, has not been overlooked; it has, since the last annual report, assumed a more tangible shape; cases have been provided for its reception, and although not yet systematically arranged, it may be examined with profit. This department has attracted the attention of several scientific and liberal members, under whose fostering care the collections will soon be of considerable extent and value, and add still further to the means of our improvement.

Early in the present year, your board determined on a course of experiments to determine the value of water as a moving power, and the most economical means of applying it. With a view to the attainment of this end, they appointed a committee, whom they authorized to make applications for pecuniary assistance to those interested, and also to the city for the use of a room in the Fair Mount water works. On due consideration, that committee determined that experiments on so small a scale as the fall at Fair Mount would admit of, would not be satisfactory; they, therefore, applied to councils for permission to use the water from the pipes, and to the corporation of Spring Garden, for leave to take up the pipes within their jurisdiction; both which requests were cheerfully granted, and an ample supply of water for their experiments thus obtained.

The Institute are under great obligations to Messrs. Rush and Muhlenberg, for the use of their lot at the corner of Ninth and Vine

streets, which they readily granted, although it is probable that the premises will be occupied for a considerable length of time.

During the past summer, the committee have been assiduously attending to the duties assigned, a task which proved of more magnitude and difficulty than at first appeared.

They have completed the requisite works, and one wheel of twenty feet diameter, at a cost of about \$1300. As the works were not prepared for experiment till early in December, the committee deemed it most prudent to suspend their operations until the severity of winter has past, that they might pursue their investigations without interruption. In the meantime, they are continuing their exertions to collect sufficient funds to enable them to prosecute their inquiries to the utmost extent, under the hope, that the spring may open with better prospects to manufacturers, when they may obtain funds sufficient for their expenditures.

The plan adopted for measuring the effect produced, is by raising a weight: this, though liable to some objections, appeared under all circumstances to be the best. Since the suspension of their operations, the committee have received from Warren Colborn, Esq. of Lowell, Massachusetts, the description of an apparatus lately invented by him for weighing the power of machines. This plan the committee have had under consideration, and so far as they are able to judge without trial, are of opinion is better adapted for its purpose than any they are acquainted with. They have not yet determined to substitute it for the method previously adopted, but if their funds admit will construct one; the cost estimated is 150 or 200 dollars, and their expenditures have already exceeded their estimate.

The committee on premiums and exhibitions have, for some time past, been actively engaged in preparing a list of premiums to be offered at the exhibition to be held in October next.

Taking advantage of past experience, the board have determined, in some measure, to change the character of the exhibitions, and open the Hall rather as a depot for the display and sale of the products of our workshops, than as a place where they will come directly in competition, and be subject to invidious comparisons. The board propose to confine the premiums to inventions and manufactures but little known, and, perhaps, to some few essays on subjects tending to advance our knowledge in the mechanical sciences; leaving all specimens, the sole merit of which is in the workmanship, to be judged of by a discerning public, well knowing that all of our deserving mechanics who expose their products to public view, will meet a full reward according to their merit, by an increased custom, and be compensated for the immediate trouble they are at, by the sale, at the Hall, of the articles they present. The Institute will, by this arrangement, avoid that odium which must necessarily fall on them by disappointing many of the competitors, while the great object for which these exhibitions were instituted, will be equally well subserved.

Your board are convinced that the monthly meetings of the members of the Institute, have been attended with the most beneficial

results. The interest of numbers has been excited; they have occasioned a free discussion and interchange of opinions upon interesting and important subjects, whereby much practical and valuable information has been elicited; and they have been the means of adding valuable articles to the library and cabinet of minerals. The board, therefore, strongly recommend the subject of the monthly meetings to the attention of the members, and hope they will continue to evince an interest in them.

The treasurer's report is herewith submitted, showing a balance in the hands of the treasurer of 763 dollars 76 cents.

During the past year, the following gentlemen have paid to the treasurer the amount specified by the constitution to entitle them to a membership for life, viz. *Messrs. John Rorer, Mark Richards, George Robinson, C. C. Biddle, Joseph Fisher, Adam Ramage, Reuben Haines, and J. H. Fisler.*

The board now surrender into your hands the trust delegated to them, under a full conviction that they have endeavoured faithfully to execute the duties entrusted to them, and they indulge the hope that their acts will prove satisfactory to the members of the Institute.

All which is respectfully submitted.

Monthly Meeting.

The stated monthly meeting of the Institute was held on Thursday evening, December 24, 1829.

MR. SAMUEL V. MERRICK, was appointed chairman.

The minutes of the last meeting were read and approved.

The following donations were received, viz.

The first nine volumes of the American Museum, presented by Mr. M. D. Lewis.

The fourteenth volume of the American Museum, presented by Mr. A. S. Roberts.

The corresponding secretary also laid on the table the works received in exchange for the Journal of the Institute, viz.

Journal of Education, Nos. 38, 39, 40, and 41.

London Journal of Arts and Sciences, for November, 1829.

Gill's Technological and Microscopic Repository.

Journal des Connaissances Usuelles et Pratiques, for September and October.

Journal Universel des Sciences Médicales, for August.

Bibliothèque Physico-economique, for September.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, for August.

Recueil Industriel, for August.

Annales de Chimie et de Physique, for July.

The paper submitted at the last monthly meeting, by Mr. Charles Potts, in reply to the query "what is the proper method of computing the power of high pressure steam engines, and by that meet-

ing deferred to this, was called up and read, and referred to the committee on publications.

On motion, the query, "what is the rationale of the action of the hydrogen gas on platina sponge, as discovered by Doebereiner?" was selected for discussion at the next meeting.

Extract from minutes.

SAMUEL V. MERRICK, *Chairman.*

ISAAC B. GARRIGUES, *Recording Secretary.*

Reply to the question, What is the true mode of Computing the Power of a High Pressure Steam Engine. By Mr. CHARLES POTTS. Read at the meeting held December 24, 1829.

TO THE FRANKLIN INSTITUTE.

FROM the dynamical relation, that the force or power of an engine is equivalent to the momentum, or quantity of motion which it is capable of producing, we shall have, putting F , for the *efficient force* of the steam on the piston of the engine, A equal to the area of the piston, V the velocity when the performance of the engine is the greatest, and P the power of the engine. $P = A \times F \times V$. Or, as it is usual to compare the power of the engine with that of horse power, let S be the standard of comparison, then $P = \frac{A \times F \times V}{S}$

This rule which answers for computing the power, either of the high or low pressure steam engine, may be otherwise expressed in words, thus,

Multiply the area of the piston by the efficient force of the steam acting thereon, this product being again multiplied by the number of feet the piston travels when the effect of the engine is the greatest, and divided by the standard of horse power, the quotient will be the relative power of the engine.

To illustrate the above rule, let us take for an example the following case. A low pressure engine, having a cylinder 24 inches diameter, makes 20 strokes per minute, each stroke being 5 feet long; the efficient force of the steam being equivalent to a pressure of 10 lbs. per square inch. Here $A = 452.4$ square inches, $F = 10$ and $A \times F = 4524$ lbs. the whole pressure on the piston, or the weight which the engine raises with a certain velocity. To find the velocity we say the engine performs 20 *double* strokes, each 5 feet long in a minute; hence $V = 20 \times 2 \times 5 = 200$ feet, the rate at which the piston travels per minute. If we assume $S = 32,000$ lbs. according to Bolton and Watt, then $P = \frac{A \times F \times V}{S} = \frac{4524 \times 200}{32,000}$

$= 28\frac{1}{2}$ horses, the power of the engine, the engine being supposed to work only eight hours in the twenty-four.

Had F , in the preceding example, been taken equal to 100 lbs. to the square inch, answering to the case of a high pressure engine, we should have deduced $P = 282\frac{1}{2}$ horses, the velocity of the engine being as before.

112 Computing the Power of a High Pressure Steam Engine.

In the preceding rule, however, we have supposed V the velocity with which the piston travels, to be such that the performance of the engine will be the greatest, or the power P , thus obtained, to be the *maximum* power of the engine, answering to the given pressure. Whether the powers assigned in the preceding examples are the maximum powers of the engine, answering to the respective pressures of 10 lbs. and 100 lbs. per square inch, will be shown in the subsequent part of this inquiry.

It is usual with engine makers, for the apportionment of *low pressure* engines, to calculate the velocity of the piston as answering to the maximum performance of the engine at 200 feet per minute, the same that is ordinarily assigned for the speed of a *horse* when tracking to the best advantage.

In rating the *high pressure* steam engine, the efficient force is commonly estimated at 100 lbs. per square inch, or the pressure on the safety valve at 150 lbs. per square inch, one-third being subtracted for the loss by friction, &c. With this pressure the maximum velocity is calculated at about 320 feet per minute.

The question under consideration, however, being general, or *not limited to any particular* pressure, we shall, therefore, inquire the value of V , the proper velocity with which the engine should move, whatever may be the pressure, as also F , the *efficient force or load* the engine should be charged with to produce it.

It is known that the velocity with which a fluid rushes into a *vacuum*, is equal to that which a heavy body would acquire in falling through a height equal to the *head of pressure*.

To find the velocity, therefore, with which steam, say at the temperature of 212° , would rush into a vacuum, we have, by experiments, the weight of a cubic foot of steam at this temperature equal to 253 grains. Hence, as 480×1000 grains : 1728 cubic inches :: 253 grains : .9107 cubic inches = to the bulk of water in a cubic foot of steam at the temperature of 212° , which is very near what it in common is assumed to be, viz. *one cubic inch*. Again, as $1728 : .9107 :: 1000$ the specific gravity of water : 5.27 the specific gravity of steam.

The force of steam at the temperature we have assumed being known to equal that of the common atmospheric pressure, or 30 inches of the barometer, taking, therefore, 13600 as the specific gravity of quicksilver, by the following analogy, we shall have $5.27 : 13600 :: 30$ inches : 77419 inches, or $6451\frac{1}{2}$ feet, the *head of pressure* corresponding to the steam, when its force is supposed just equal to that of the common atmosphere.

The velocity that would be acquired by a heavy body in falling through this height, is readily found from the dynamical relation $V = 2 \sqrt{gs}$, where V denotes the velocity, s the space fallen through, and $g = 16\frac{1}{12}$ feet the force of gravity. Substituting $6451\frac{1}{2}$ for s , in this expression, we shall find $V = 2 \sqrt{gs} = 644$ feet per second, the *velocity with which the steam would rush into a vacuum*.

Now since the density of steam must be as the pressure, let D

denote the density (or pressure) of steam at any temperature, and H the corresponding head of pressure.

Assume R , equal to the density of any medium into which we shall now suppose the steam to rush. Then it is obvious that the steam having the density D , when opposed by the medium, the density of which is R , will have the same velocity as though it rushed into a vacuum, with a pressure or density equal to $D - R$.

To find the head of pressure corresponding to this density, we have by analogy $D : D - R :: H : H \left(\frac{D - R}{D} \right) =$ to the head of pressure, or the height a body must fall to acquire a velocity equal to that with which the steam would rush into the medium.

The spaces described by falling bodies, being proportional to the squares of the velocities. If, now, v be put to represent the velocity with which steam (when its pressure is equal to that of the common atmosphere) rushes into a vacuum, or 644 feet per second, and h , its corresponding head of pressure, or $645\frac{1}{2}$ feet. Then V being put for the velocity with which steam, having the density equal $D - R$, would rush into a vacuum, we shall have by the above proportion $h : H \left(\frac{D - R}{D} \right) :: v^2 : V^2$. From whence it follows that

$V = v \sqrt{\frac{H}{h} \left(\frac{D - R}{D} \right)}$ which is also equal to the velocity in feet per second, with which steam, having the density or pressure D , would rush into a medium, the density (or resistance) of which we assumed equal R .

In order to apply the above expression, for finding the velocity with which steam of any density, passes into the cylinder of a steam engine, or the velocity with which the piston is urged, it is obvious, supposing the density of the steam, and, consequently, the motion of the piston, to be uniform during the working of the engine, that R must be taken equal to the *total resistance* which the preponderating pressure of the steam has to overcome, that is, R may represent the load, friction, &c. of the engine.

The foregoing expression for the velocity relates to that of steam passing through a simple aperture; the velocity with which the piston moves, therefore, will be to the velocity with which the steam rushes through the steam pipe, or *openings*, as the area of the opening is to the area of the piston. Put $O =$ to the area of the opening, and $A =$ to the area of the piston, then the velocity of the piston

will be expressed by $\frac{O}{A} \times v \sqrt{\frac{H}{h} \left(\frac{D - R}{D} \right)}$ it is obvious that the greatest velocity with which the piston may move, will be when $R = 0$ and the velocity in this case would become $\frac{O}{A} \times v \sqrt{\frac{H}{h}}$. Now

it is established in dynamics, that when the velocity with which any engine works is *one-third* of the *greatest velocity* with which it is

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capable of working, then will the work done be a *maximum*, or the greatest possible.

Hence it follows that the velocity with which the piston should move in order that the performance of the engine may be the greatest, or the value of V answering in the formula for the power of an engine is $V = \frac{1}{3} \times \frac{O}{A} \times v \sqrt{\frac{H}{h}}$. As the pressure of steam employed in working an engine is usually estimated by the number of atmospheres, let n express the ratio between the common atmospheric pressure and the pressure D , then we shall have the head of pressure $H = nh$ and, consequently, $V = \frac{O}{A} \times \frac{1}{3} v \sqrt{n}$ the velocity with which the piston should travel per second to produce the greatest effect.

In uniform motions, the force being as the squares of the efficient velocity, we have D , the force answering to the least velocity, to $D - R$, the force answering to the velocity when the effect of the engine is a maximum, as $(1)^2$ is to $(\frac{2}{3})^2$ whence $D - R = \frac{4}{9} D$ or

$R = \frac{5}{9} D$. At the starting of a steam engine it is known, that

when the pressure on the piston preponderates, the engine moves with an accelerated motion, and continues so to move, until the action of the steam upon the piston has become so far diminished, by the increased velocity of the engine, that the power and resistance become equal. Hence we may consider $D - R$ either as the effective force of the steam, or the load, &c. to which it is a counterpoise.

Let the effective force of the steam in a low pressure engine be taken at 10 lbs. per square inch, as in the former example; and suppose $O : A :: 1 : 50$, which is near the usual proportion; then the velocity of the piston when the effect of the engine is a maximum, will be $V = \frac{O}{A} \times \frac{1}{3} v \sqrt{n} = \frac{1}{50} \times \frac{1}{3} \times 644 \times \sqrt{\frac{10}{15}} = 3.36$ feet per second or $201\frac{1}{2}$ feet per minute.

Again, suppose the effective force of steam with which a high pressure engine is to work is equal to 60 lbs. per square inch; here $n = 4$, and supposing $\frac{O}{A}$ to be as before, we should have $V = \frac{1}{50} \times \frac{1}{3} \times 644 \times 2 = 8.5$ feet per second, or 510 feet per minute, which would be at the rate nearly of 6 miles per hour.

Let $n = \frac{100}{15}$, or, that the engine works with an effective force equal to 100 lbs. per square inch, then $V = \frac{1}{50} \times \frac{1}{3} \times 644 \times \sqrt{\frac{100}{15}} = 11$ feet per second, or 660 feet per minute. Hence $100 \text{ lbs.} \times 660 = 66000$ lbs. the momentum per square inch on the area of the piston.

In a former example we supposed an engine having the pressure

on the safety valve equal to 150 lbs. per square inch, to work at the rate of 200 feet per minute only; hence putting $\sqrt{\frac{D-R}{D}} = \frac{200}{660}$

we shall find R nearly equal to $\frac{10}{11} D$, and, consequently, we shall have answering to this case, $133 \text{ lbs.} \times 200 = 26600 \text{ lbs.}$, the momentum per square inch on the area of the piston, which is nearly $\frac{1}{3}$ d less than when the engine carried a less load with a greater velocity. This comparison may suffice to show the advantage in attending to the proper adjustment of the load.

The method of finding the maximum of variable quantities being particularly interesting and useful, in many questions relating to mechanics, the following will be found useful to those who may be unacquainted with the fluxional or differential calculus.

Let a , denote any constant quantity, and x being supposed to vary; then when $x \times \overline{a-x}$ becomes a maximum, we shall have $x = \overline{a-x}$ or $x = \frac{a}{2}$.

This proposition may be readily demonstrated by supposing a to represent the diameter of a semicircle, and x and $a-x$ the segments of this diameter formed by a line drawn from the circumference perpendicular on the diameter, for it is known that the product of the segments is always equal to the square of the perpendicular, and this is the greatest when it divides the diameter into two equal parts. From this it also follows, that $x \times \overline{a-x} \times \overline{a-x}$ or $x \times \overline{a-x}^2$ will be a maximum when $x = \frac{1}{2} (a-x)$ and consequently

$$x = \frac{a}{3}.$$

When $x \times \overline{a-x} \times \overline{a-x} \times \overline{a-x}$ or $x \times \overline{a-x}^3$ becomes a maximum, then $x = \frac{1}{3} (a-x)$ or $x = \frac{a}{4}$. And in general when

$x \times \overline{a-x}^n$ becomes a maximum, then $x = \frac{1}{n} (a-x)$ or $x = \frac{a}{n+1}$. If, for example, W denotes the absolute effort of any moving force, when it has no velocity; and suppose it not capable of any effort when the velocity is a ; let f be the effort answering to the velocity u ; then the action being supposed constant, it will vary as the square of the efficient velocity, hence $W : f :: (a-0)^2 : (a-u)^2$

and, consequently, $f = \frac{W}{a^2} \times \overline{a-u^2}$. The momentum of the force

will be $fu = \frac{W}{a^2} \times (u \times \overline{a-u^2})$ which is obviously a maximum when $u \times \overline{a-u^2}$ is the greatest, the quantities, W and a , being

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considered invariable. From what has already been shown, $u \times \overline{a - u^2}$ will be a maximum, when $u = \frac{1}{2} (a - u)$ or $u = \frac{a}{3}$. This is the theorem that we before alluded to, viz., that when the velocity with which any engine works is one-third of the greatest velocity with which it is capable of working, then will the work done be the greatest possible.

In this conclusion, however, it must be understood that the quantity of weight only is considered, no regard being paid to the variations of friction arising from the motions of the weight.

Let D , as before, express the force or pressure of steam, and put $1 : m$ as any given weight on the piston, is to the resistance which would arise from the friction of this weight, when the engine worked with a given velocity, a .

From the construction of the steam engine, it is obvious, that when the engine works without any load, the resistance which arises from weight must be comparatively small; let it be assumed, therefore, equal to unity per square inch on the piston when the velocity is a

and pressure D , then $a = \frac{O}{A} \times v \sqrt{\frac{H}{h} \left(\frac{D - m + 1}{D} \right)}$ and a , will express the greatest velocity with which the engine is capable of working.

Let u , denote the velocity of the piston, when loaded with a weight, L , the motion of the engine being uniform; then supposing the friction to be always in the compound ratio of the weight and velocity, the friction arising from the load when the velocity is u , will be $\frac{mLu}{a}$, and that from the parts of the engine will be $\frac{mu}{a}$.

Hence, putting W , equal to the weight that would completely stop the motion of the engine, we shall have $\frac{W \times \overline{a - u^2}}{a^2}$ equal to the power or action of the engine.

Now when the motion of the engine becomes uniform, the action and resistance become equal, consequently, $\frac{W \times \overline{a - u^2}}{a^2} = L + 1 + \frac{mLu}{a} + \frac{mu}{a}$ from whence we obtain $L = \frac{W}{a} \times \frac{\overline{a - u^2}}{a + mu} - 1$ and when the momentum of the load becomes a maximum, the velocity, u , will be found by resolving the following equation: $2 mu^3 + (3a - 2am) u^2 - 4a^2 u + a^3 = 1$.

If now we suppose the friction, m , to be constant, or not increased by the augmentation of velocity, and rW , to represent the resistance of the engine when operating without a load; then $\frac{W \times \overline{a - u^2}}{a^2} =$

$L + mL + rW$. and consequently, $L = \frac{W}{a^2 + ma^2} \times (\overline{a - u^2} -$

ra^2). When the momentum of the load, Lu , becomes a maximum, we shall find the velocity $u = \frac{a}{3} \times (2 - \sqrt{3r + 1})$.

It is obvious that rW , may be taken to express both the loss of power from the *weight and friction of the engine*, and also that which arises from the nature of *crank motion*. Before we give an example in illustration of the preceding rules, it may be well to say a word or two with regard to the crank.

In a paper formerly presented to this meeting, in answer to the abstract question, "Whether the crank involved a loss of power," I endeavoured to show the affirmative, by simply calculating the effort of the crank at several points in its revolution, and comparing it with the power or energy applied at the same places.

As it is important in computing the power of a reciprocating steam engine, that due allowance should be made for the loss sustained from the application of the crank in its construction, we shall again revert to the subject.

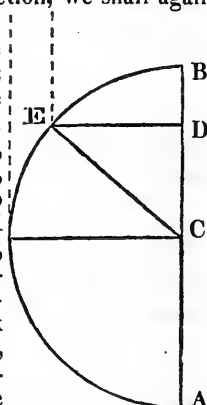
Let AB , in the adjoined figure, represent the diameter of the circle described by the crank; then will AB , also, be the length of a single stroke of the engine, and if F be supposed equal to the effective force on the area of the piston, then $F \times AB$, will be the momentum, or weight, the engine could raise, supposing no crank to intervene.

Suppose, now, in the application of the crank, the mechanical contrivance is such, that the *connecting rod* acts on the crank CE , always parallel to AB , (to the piston rod) then when the crank is at *right angles* to AB , or the connecting rod, the *whole energy* of the power, F , will be effectual in turning the crank. The effort of the power to turn the crank at any other point, as at E , will be as the

effective lever DE , hence as $CK : DE :: F : \frac{F \times DE}{CK} =$ to the effort of the crank at the point E . And it is easy to see, that, as the line DE , in a single stroke of the engine, would describe the semi-circular area $AKEB$, the *sum of all the efforts of the crank* will be $\frac{F}{CK} \times \text{area of semicircle}$.

Hence, putting $AB =$ the diameter of the circle $= 1$, then $CK =$ the length of the crank $= \frac{1}{2}$, and the area of the semicircle $AKEB = \frac{.7854}{2}$. Consequently $F \times AB$ will be equal to F , and the

sum of all the efforts of the crank will become $2 F \times \frac{.7854}{2}$ equal to $F \times .7854$. From whence it follows that $F : F \times .7854 :: 1 :$



.7854. And we shall have the loss of power from the crank equal to $1 - .7854$ equal to .2146, or $\frac{1}{5}$ th, nearly.

In an engine working without a beam, where the connecting rod passes immediately from the cross head to the crank of the *fly wheel*, the proportion between the rod and crank being as 6 to 1, the loss will be found equal to $\frac{3}{10}$ ths, nearly. And in the *lever beam construction*, particularly when the *stroke is long and beam short*, considering both crank and parallel motion, the loss in transmitting the power from the piston to the fly wheel, will be still greater.

In the above demonstration we have supposed the force, F , acting on the piston, to remain constant during the stroke. It is known, however, that as the velocity of the piston is continually accelerated from nothing at the top and bottom of the cylinder, to its greatest velocity at or near the middle, resembling in this respect the oscillations of a pendulum: and because the force varies as the square of the relative velocity of the steam and engine; if we suppose the force on the piston to be F , when the engine has no velocity, as at the top or bottom of the cylinder, and that the force on the piston is f , when the relative velocity is $(1 - \frac{1}{3})$ or $\frac{2}{3}$, we shall have $f = \frac{4}{9} F$.

This circumstance has induced some persons to infer, that, as the force on the piston diminishes as it approaches the middle of the cylinder, whilst the effort of the crank at the same time increases, a just equilibrium is maintained, and hence no power lost.

In the demonstration that has been given, let F , now, be taken equal to the force on the piston when at the middle of the cylinder, (as at C), and that when the piston is at D , the force has increased to dF . When the force is constant, the effort of the crank at E , will be $F \times \frac{DE}{CK}$, and it is evident, if the force on the piston has increased

to dF , that the effort of the crank will become $dF \times \frac{DE}{CK}$, hence the ratio between the power and the effect will be the same, whether the power is constant or variable.

The comparative advantage between engines with long and short cylinders may be readily inferred from the above illustration of crank motion.

We shall now exemplify the preceding observations, by supposing the following case.

It is intended to work a high pressure steam engine, with a force per square inch on the safety valve equal to 150 pounds, the area of the piston being 50 square inches, and the loss from crank motion equal $\frac{3}{10}$ ths of the power. It is found by trial that a pressure equal to *three pounds* per square inch on the piston, is amply sufficient to overcome the weight and friction of the engine when unloaded, or that this pressure will start the engine when the piston hangs midway between the centres. Required the velocity, load, and power of the engine when operating to the greatest advantage.

Friction being supposed constant, we shall have a , the utmost ve-

locity with which the engine is capable of working, $a = \frac{O}{A} \times v$

$\sqrt{\frac{n \times (D - rW)}{D}}$ where $\frac{O}{A} = \frac{1}{50}$, as formerly, $v = 644$ feet, and

it is obvious that D , the effective force of the steam on the piston, is equal W , the weight that would stop the engine.

The resistance of the engine being 3 pounds per square inch, or $\frac{1}{50}$ ths of the power, we have $r = \frac{3}{10} + \frac{1}{50} = \frac{32}{100}$, whence $D = W = 150$ lbs. $D - rW = 102$ pounds, and the ratio between the common atmospheric pressure and the active pressure of the steam, equal

$$n = \frac{102}{15}.$$

These values substituted in the above formula, will give $a = 30$ feet per second, the velocity with which the engine would run without a load.

When the engine is loaded the performance will be a maximum when its velocity $u = \frac{a}{3} \times (2 - \sqrt{3r + 1}) = \frac{30}{3} \times (2 -$

$$\sqrt{3 \times \frac{32}{100} + 1} = 6 \text{ feet per second, or } 360 \text{ feet per minute.}$$

From experiments by Coulomb and others, the friction of iron gudgeons working in brasses, was about $\frac{1}{6}$ th of the weight, and it was also determined that this friction was very little, if any, increased by an augmentation of the velocity.

Hence, from the foregoing expression for the load, we have $L = \frac{W}{a^2 + ma^2} \times (a - u^2 - ra^2)$, whence, by substituting 150 for W ,

$$30 \text{ for } a, 6 \text{ for } u, \frac{32}{100} \text{ for } r, \text{ and } \frac{1}{6} \text{ for } m, \text{ we shall obtain } L = \frac{144}{525}$$

$W = 41$ pounds per square inch on the area of the piston; the load the engine may carry, independent of the weight and friction of the machine.

The momentum of the load Lu , per minute, when the engine performs to the greatest advantage, will be $41 \times 360 = 14760$ lbs. per square inch, and multiplying by the area of the piston, 50, we have 738000 lbs. the whole momentum of the engine per minute.

Assuming the standard of horse power equal to 32,000 lbs. raised 1 foot high per minute, the power of the engine will be equal to 23 horses.

All of which is respectfully submitted, by yours, &c.

CHARLES POTTS.

Philadelphia, November 19, 1829.

Hints Respecting the Manufacture of Indigo in the manner practised in Bengal.

THE following hints are extracted from a letter written by a gentleman in Philadelphia, in reply to inquiries made upon the subject to which it refers, by a person about to engage in the indigo manufacture.

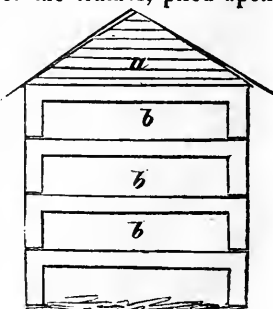
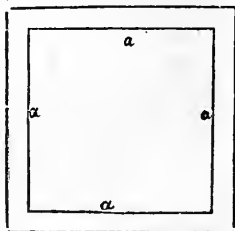
"The book to which you refer, contains nothing more than a general notice of the practice pursued in India, in the making of indigo, none of those specialities required by one who wishes practical information is to be found in it; but, by a remarkable coincidence your letter came to hand just at the time the subject of the Bengal mode of procedure was treated of in the Journal of the Franklin Institute. I send you the numbers for October and November, 1829, containing the article.

"Your inquiries respecting presses, your observations on the manufacture, and the information contained in the Journal, have conspired, with the dull weather, and set my head to work in making indigo, and I now send you the result of my cogitations, upon the value of which you will place your own estimate.

"The drying, I see, is an important part of the process, and this, I apprehend, may be much simplified, and all the baneful effects of bad weather guarded against.

"The plan I would recommend, is, to dry the indigo in the same way in which the glue makers dry that article, which is as follows. Square frames are made of inch boards, cut into strips about 5 inches wide, as *a, a, a, a*. On each corner a block of wood is fixed, the four serving as feet to support the frame; these may be of such height and thickness as experience may prove to be best adapted to the intended purposes of support, and height enough to admit a free circulation of air. These are to be placed upon each other, as represented in the annexed diagram, where *a* shows the boarded end of a moveable roof, and *b, b, b*, three of the frames, piled upon each other, and kept separated by the feet at their corners, the roof, also, being furnished with similar feet; the whole may be readily separated, spread out, and completely exposed, whenever the weather is favourable. There may also be moveable sides, made either in the manner of weather boarding, or of canvass, as may be found most convenient.

"The drying of the indigo upon boards, appears to me to be a very injudicious mode, as, in this case, evaporation takes



place from the upper surface only, the moisture absorbed by the boards being hardly worth mentioning. The frames which I have described, should have netting strained over them, or, perhaps, coarse canvass; this, undoubtedly, would accelerate the drying one-half.

“In case of exposure to injury from flies, in wet and damp weather, the pile of frames may be elevated so as to place a chafing-dish of burning charcoal beneath them; the heated air from this, if the sides are properly enclosed, will drive off the flies, and at the same time, from its constant and rapid ascent, accelerate the process of drying. I am not informed respecting the effect of the direct rays of the sun, or the particular influence of carbonic acid upon indigo, but am fully impressed with the idea, that the procedure which I have described, will be found to be a real improvement, and enable a few hands to manage the drying of a large quantity.

“The frame into which the indigo pulp, or batter, is put, for the purpose of pressing, should have numerous small holes in it; these holes should open into grooves under the bottom of the frame, or box; this would make every hole efficient in allowing the escape of moisture.

“The material of which the cloth which forms the lining should be made, will be learned by experience; probably either linen, cotton, or wool, may answer; I am inclined to the opinion that one of cotton in contact with the indigo, surrounded by another of wool, will be most effectual.

“With respect to the improvement of your mill, I foresaw when I pressed you to visit mine, that to this you must come at last. A millwright and miller can, I dare say, be obtained to suit your purpose; the medium wages of such a one, here, would be about \$300 a year; what one can be hired for to dwell in your part of the country, will depend upon accidental circumstances; his good qualities, and his disposition to visit distant parts, will be influential items. I know that the producers of sugar, indigo, and cochineal, the diggers of silver, and the washers of gold, will be a set of poor miserable devils, if they depend for their supply of food and clothing upon any country except their own; and even then, should they resort to paper money, they, with it, will increase crime, and diffuse poverty.”
R.

Account of some Experiments upon Caoutchouc, or Indian Rubber; recently instituted at Philadelphia, by JOHN K. MITCHEL, M. D. Lecturer on Chemistry, &c.

WE have received from the above named gentleman, some account of his experiments on the distension and inflation of Caoutchouc; he has also read a paper upon the subject, before the American Philosophical Society, and several notices respecting them have likewise appeared in the daily journals. We shall probably hereafter lay some

further details before our readers. The communication referred to, contains the following information:—

Mode of making Gum Elastic into bags, sheets, &c.

Soak the gum elastic in sulphuric ether until soft and almost inelastic, which, in good ether, will take from 10 to 24 hours. Then, if it is a plate, cut it with a wet knife, or parallel knives, into such sections, or sheets, or shapes, as may be desired, and suffer them to dry; or, if a bag, apply a pipe, or stop cock, and inflate with the mouth, rapidly if the bag should expand equally, more slowly, and with occasional pauses, if unequally. By such means a bag may be made so thin as to become transparent, and light enough to ascend when filled with hydrogen. By graduating the extent of inflation, sheet caoutchouc, of any given thickness is produced. If for blow-pipes, or other purposes, for which it is desirable that the bags should possess contractility, let them be inflated to the desired size, and after an hour, let out the air. Ever afterwards they will suffer as great a degree of extension, and again contract. If permanent sheets are wanted, the inflated bags are to be hung up, until dry, after which no sensible contraction will ensue.

Bags softened by ether may be readily stretched by hand, over lasts, hat blocks, or other moulds, so as to assume the shape desired, and may, therefore, be applied to a variety of useful purposes. In the form of straps, and twisted strings, its elasticity offers many useful applications. It may be made to assume the form of a tube, to connect parts of chemical and other philosophical apparatus with each other; it may be employed as covers for bottles, corks, &c.; and indeed wherever the passage of steam, or air, is to be prevented. It is also susceptible of numerous applications in medicine and surgery.

Dr. Mitchell has extended a bag which was about the size of a skinned English walnut, and which weighed three drachms and a half, until its diameters were 15 and 13½ inches respectively.—Larger bags have been made to attain a diameter of six feet; one of these, when filled with hydrogen, escaped, and was found at the distance of 130 miles from the city. Balloons so formed have been exhibited before the several classes attending chemical lectures in Philadelphia.

The discovery, by the same gentleman, that essential oil of sassafras will soften caoutchouc so that it may be applied to any surface with a brush, promises, also, much utility. When dry, it becomes again simple caoutchouc, with all its original elasticity. If it be applied on a plate of glass, dried, and then immersed in cold water, the sheet may be peeled off. It has been spread upon paper, and after becoming dry, the whole immersed in water, when on stretching it the paper would, of course, separate into fragments, between which the gum elastic might be stretched so as to separate them to the distance of a quarter of an inch, without itself giving way, notwithstanding its tenuity. Such a varnish will never crack, one of its essential attributes being elasticity.

By turning to page 34, Vol. I, of this Journal, for 1826, a mode

will be found of distending caoutchouc after heating it in water. The distension in this case was not permanent; its application was to the blow-pipe only.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

A sketch of the History and Properties of Caoutchouc. By CHARLES DAVIS, M. D.

THE increasing applications of caoutchouc, or Indian rubber, as it is commonly called, to useful purposes, render it an object of such general interest, that a short account of its properties, and the sources from whence it is derived, may not prove unacceptable to your readers.

This substance was first introduced into Europe about the beginning of the last century. Nothing definite was known with regard to its origin. Some philosophers supposed it to be an artificial production. In 1735 the Academy of Sciences, in Paris, sent a company of gentlemen to South America, for the purpose of measuring a degree of the meridian; in the following year, one of them, M. Condamine presented a memoir to the Academy, in which he states, that caoutchouc is procured from a tree growing in the province of Esmeraldas, in Brazil. When incisions are made into the bark of this tree, a milky fluid exudes, which, when exposed to the air, concretes and forms caoutchouc. The same tree was afterwards found in Cayenne, and on the banks of the Maragnon. It has since been discovered, that various plants which grow in warm climates yield caoutchouc. A considerable quantity of it was procured, by Mr. Howison, from a climbing plant, which is found in several of the East India islands. In Prince of Wales' Island, a party of soldiers were employed in clearing a passage through a forest; they used their sabres to cut away the underwood, and were surprised to find the blades covered with a substance which had all the characteristics of caoutchouc.—The plant from which the gum exuded, was a thick vine: when deep incisions were made into the bark, a fluid was obtained which had the consistence of cream; when this fluid was spread upon any surface, it concreted into a thin stratum of caoutchouc—Mr. Howison made moulds of wax, in the form of boots, gloves and bottles; the fresh juice of the plant was spread upon these moulds, and suffered to dry; in about ten minutes a second coating was applied; it required about thirty coats to form a boot of the proper thickness. When the boots and gloves were finished, they were removed from the moulds by turning them over at the tops, and stripping them off, as a glove is drawn off from the arm. Gloves and stockings, made of cotton yarn, were drawn upon the moulds, and then immersed in vessels containing the fluid gum. When taken out, and exposed to the air, an envelope was formed upon every fibre of the cotton, so that for gloves, or stockings, no additional coating was necessary. Pieces of strong canvass, coated with the gum, were formed into

soles, heels and straps; these, when dry, were moistened on the surface with the recent juice, and applied to the stockings, to which they became firmly agglutinated; and thus boots were formed, which presented a very neat appearance. By spreading the liquid on the surface of nankeen, Mr. Howison formed a cloth which was very flexible, and perfectly impervious to water. He recommends this cloth as a suitable material for garments; no sewing would be required; the edges of the different pieces being placed in contact, and wet with the recent juice, would adhere, and the article would be ready for use.*

From these facts it is obvious, that if caoutchouc could be procured in large quantities in a fluid state, it might be applied to many important purposes. It, therefore, becomes an object to devise some means by which the solid gum, as it occurs in commerce, could be rendered fluid, or could be wrought into the different forms best adapted to various uses. From a variety of experiments by different individuals, the following results have been obtained.

When heated in close vessels, to a high temperature, caoutchouc melts into a black viscid substance resembling tar, which does not concrete on cooling. When this fluid is incorporated with oil of turpentine, it forms a tough varnish, which has been used to defend the surfaces of engraved steel dies, plates, &c. from the action of the air and moisture. The varnish may be removed by a brush charged with warm oil of turpentine.

Boiling water softens caoutchouc, but does not dissolve it; two pieces which have been boiled for a long time, when strongly pressed together, form a permanent adhesion to each other. When softened in this manner, it may be drawn out into thin lamina resembling gold beater's skin. An artist named Matthias More, conceived the idea of substituting transparent slips of caoutchouc for the glass slides on which the figures are painted in magic lanterns. He purposed to paint, or print, the figures on a long strip of caoutchouc; this was to be wound on and off a cylinder, thus bringing the figures successively before the lens. By soaking the caoutchouc for many hours in warm water, he succeeded in stretching it to a very great extent, and in rendering it exceedingly thin and transparent. Bottles of this substance were inflated by means of a pair of bellows—balloons were thus formed, which, when filled with hydrogen gas, ascended into the atmosphere.†

Gum elastic bags may be dilated, without previously softening them, by forcing in air with a condensing pump.

When caoutchouc is boiled in the expressed vegetable oils, in wax, butter, or animal oil, it is dissolved, and combining with these substances forms viscid inelastic compounds. Ether, naptha, and cajeput oil, appear to be the only solvents from which it can be separated unchanged. When the ethereal solution is poured upon water, it spreads equally over the surface, the ether rapidly evaporates, leaving a thin film of caoutchouc, which retains all its characteristic properties. The rapidity with which the ether evaporates renders

* Philosophical Magazine, vol. 6.

† Ibid. 59.

it very difficult to apply this solution to any practical uses; this, together with the expensiveness of the solvent, has hitherto rendered its applications extremely limited.

"In order to form tubes of caoutchouc, the best method is to cut a bottle of this substance into a long single slip, and soak it for half an hour or an hour in ether: by this means it will become soft and tenacious, and if wound dexterously on a greased mould, bringing the edges in contact with each other at every turn, and giving the whole a moderate and equal pressure by binding it with a tape wound in the same direction as the caoutchouc, a very effectual union will be produced."* Dr. Roxburg, to whom we are indebted for a botanical description of the East Indian vine from which the caoutchouc is obtained, dissolved this substance in cajepout oil. When alcohol is added to this solution, the caoutchouc is separated from the oil, and floats upon the surface in a semi fluid state; when exposed to the air it becomes firm and retains its elasticity perfectly.

"Mr. T. Hancock has succeeded, by a process which he has not published, in working caoutchouc with great facility and readiness. It is cast into large ingots or cakes, and being cut with a wet knife into leaves or sheets, about one-eighth or one-tenth of an inch in thickness, can then be applied to almost any purpose to which the properties of the material render it fit. The caoutchouc thus prepared is more flexible and adhesive than that which is found in the shops, and is worked with singular facility. Recent sections made with a sharp knife, or scissors, when brought together and pressed, adhere so firmly as to resist rupture as strongly as any other part; so that if two sheets be laid together and cut round, the mere act of cutting joins the edges, and a little pressure on them makes a perfect bag of one piece of substance. The adhesion in those parts where it is not required is entirely prevented by rubbing them with a little flour. Bags made of this substance have been expanded by having air forced into them until the caoutchouc was quite transparent, and when expanded by hydrogen they were so light as to form balloons with considerable ascending power, but the hydrogen gradually escaped, perhaps through the pores of this thin film of caoutchouc."† Dr. John K. Mitchell has lately formed large balloons of caoutchouc, by softening the bottles in ether, and afterwards inflating them; one of these balloons, filled with hydrogen gas, rose into the air, and fell, it is said, at the distance of 130 miles from the place of ascension.

The elasticity and tenacity of caoutchouc, its power of resisting the action of most chemical agents, and the recent improvements in working it, promise to render its applications in the arts much more extensive than they have hitherto been. The process for softening the caoutchouc, is, to leave the *bag* 10 or 12 hours in *common ether*, and then to blow it out to the desired thinness, by fastening into the aperture a tube and stop cock.

Philadelphia, January 18, 1830.

* Rees' Cyclopædia, art. Caoutchouc.

† Quarterly Journal, vol. 17.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN NOVEMBER, 1829.

With Remarks and Exemplifications, by the Editor.

1. For a *Self-moving Cradle*; Anthony Buchenberger, New York, November 3.

A common swinging cradle is to be made to vibrate by a spring movement, like that of a time-piece, which is to be let into one of the uprights, and of this movement the cradle becomes the pendulum.

The claim is to "the method of working a cradle, and the adaptation of the movement above described."

In the days when cradles were as numerous as infants, and swaddling bands and chin stays were accounted necessary to preserve the juxta position of the joints, it was frequently proposed to rock the child to sleep by clock work, and we have little doubt that it has actually and repeatedly been carried into practice; at all events, the proposition of the matrons and the nurses is now to be realized, and our children are to be made to sleep against time, provided their parents consent to it. We are very apprehensive, however, that the determined departure of the moderns, from the usages of primitive times, will interfere with the patent mode of inducing sleep, and prevent its becoming a profitable concern.

2. For an improvement in the *Manufacturing of Chandeliers, by the Crystallization of Salts* upon their frames; Franklin Ransom, Buffaloe, Erie county, New York, November 3.

By turning to page 188, of our last volume, it will be seen that a patent was granted on the 13th of June last, to F. B. Merrill, of Buffaloe, for ornamenting the skeletons of chandeliers, &c. by immersing them in a saturated solution of alum, or other salt; chandeliers so ornamented being intended as cheap substitutes for those of cut glass. The present patent is obtained for the same thing precisely, and both the inventors or discoverers reside in the same town; which of them invented, or discovered it first, or whether they discovered it originally in a chemist's laboratory or a lady's boudoir, we are not informed. Ornaments of this description were familiar objects in our boyish days, sometime far back, in the last century; although it had then been discovered that crystals would attach themselves to twigs interwoven in the form of baskets, grottoes, and pyramids, the knowledge that sticks, or wires, bent in the shape of the frame of a chandelier, was, it seems, reserved to become one of the notable improvements of the present day.

3. For a new and useful machine for winding up clocks, called "*Ward's Self-moving Power*"; Richard Ward, Waterbury, New Haven county, Connecticut, November 5.

Without attempting a critical analysis of the name, "a self-moving power," which appears to us rather incongruous, we will at once proceed to a short description of the winding apparatus intended to be applied to a clock. Air, like other bodies, is expanded by heat and contracted by cold; it is proposed to use the expansion and contraction of this fluid, by natural changes of temperature, to keep a clock perpetually wound up.

An air chest, or reservoir of the capacity of four or five gallons, it is estimated by the patentee, will be sufficient for a time-piece with a striking movement. A tube is to pass from this air chest into a small gasometer, constructed with three concentric cylinders, precisely like those used for gases by the chemist. When the air expands in the chest, it is forced through the tube, and raises the middle cylinder of the gasometer, and when it contracts the cylinder consequently falls. This cylinder is so suspended that a cord, or catgut, which passes over a pulley, turns a drum or barrel, and winds the clock, whether ascending or descending. The particular modes of effecting this, described by the patentee, we shall not at present detail; those conversant with machinery will be at no loss in perceiving how this may be done.

That a delicately made time-piece may be wound up by the expansion and contraction of fluids or solids from natural changes of temperature, is an admitted fact. In our article on *Perpetual Motion*, vol. 2, new series, page 326, we have made the following remarks upon the subject of the application of some of the moving objects in nature. "Some of these may be employed to keep clocks and other engines wound up, so that their action shall be continued. The contractions and expansions of a long bar of metal, from changing temperature, the rise and fall of mercury in the barometer, the perpetual current of rivers, the flux and reflux of the tide, regular and irregular winds, and drafts or currents of air, the hygrometric changes in certain substances, are of the kind intended; the employment of some of them is familiar, and the possibility of using the whole of them, as well as some others which have not been enumerated, will be evident to most of our readers."

The possibility, and eligibility of a thing, are, however, very distinct questions; in machines for which patents are obtained, and which, of course, are expected to yield a profit to the patentee, the latter is the only point of importance; we apprehend that the present plan, like many of its predecessors, will fail to recommend itself by its actual utility, so as to repay the patentee for his expenditures of time and money.

4. For a *Churning Machine*; Horace Saxton, Paris, Oneida county, New York, November 6.

This is a churn with a rotary dasher turned with a wheel and pinion, by means of a crank. "The body of the churn to be made of potter's clay and burned, which improvement only is claimed as his invention."

It is to be hoped that those potters who have for many years been in the habit of forming their clay into churns, will do justice to the claims of the *inventor*.

5. For *Improvements in Steam Engines*; Mellen Battle, Albany, New York, November 6.

In the specification it is stated, that "the objects of this improvement, are, to lessen the quantity of fuel, to make the generator of steam more durable, less subject to explosion, more powerful, and with a less quantity of water."

These are important objects, and, in a letter which accompanies the application for a patent, it is stated, that there is a clear saving of fuel of *at least* two thirds. As we are of opinion that it is not possible, in the nature of things, to approach so large a saving in the fuel employed for the generation of steam, we are not prepared by such a declaration to find the claim founded upon correct principles, or well tested experiments.

The improvement is said to consist of four distinct branches.

1st. A new combination of steam pipes, or generators, with the common high or low pressure boiler.

2nd. Placing a reservoir between the high and low pressure engines, and connecting them with one shaft.

3d. The formation of a generating supply pipe.

4th. The formation of a generator in the smoke pipe.

We cannot enter into particulars, but will observe that tubes, charged with water, or steam, are to be used in conjunction with the ordinary boiler; that it is proposed to use steam twice; in one cylinder as high, and in another as low steam, as in Wolfe's engine, but in a manner somewhat modified; that pipes containing steam be placed within the smoke pipe, or chimney, that the contained steam may be rarified by the heated air which is escaping.

This last proposition is at variance with what is now considered as well established by experience, and as sound philosophy; that little or no advantage is gained by heating steam in this manner, as whilst it is thus heated, it also becomes less dense; this error of heating ready formed steam, appears to us to prevail in some other parts of the proposed alterations. We have not taken time, however, to give that critical attention to *all* the proposed alterations which would justify a decisive expression of our opinions respecting them, nor have we room, here, to spare for the investigation. The claim, of course, consists of the four enumerated improvements.

6. For an improved *Cooking Stove*; Joseph Hurd, jun. Boston, Massachusetts, November 10.

"This improvement consists in the combination of a furnace and oven, partially, or wholly, surrounded by polished tin, or other metal, as reflectors; and a boiler which is set upon the oven, and is so constructed that it receives into a cavity, or chamber, at its bottom, the

smoke and hot air from the furnace, which previously passes around the oven."

7. For a *Furnace with Reflectors*; Joseph Hurd, jun. Boston, Massachusetts, November 10.

"This improvement consists principally in the application of tin, or other polished metal, to serve as a reflector, around, or partially around the furnace, by means of which a great portion of that heat is saved, and applied particularly to objects for which it is wanted, which must be lost by radiation, or absorption, when the fire is made on brick work, or in common iron stoves."

8. For an *Oven with Reflectors*; Joseph Hurd, jun. Boston, Massachusetts, November 10.

"This improvement consists principally in the application of tin, or other polished metal, arranged around, or partially around the oven, which will reflect back upon it the heat which would otherwise be lost by radiation or absorption, according to the material made use of."

9. For an *Improved Boiler*; Joseph Hurd, jun. Boston, Massachusetts, November 10.

"This improvement consists principally in having a chamber, or cavity, at the bottom of the boiler, which receives all the smoke and hot air from the furnace, and from which all external air is excluded. It has a flue, or pipe, through the side, to carry off the smoke into the chimney, or elsewhere."

We expect shortly to see the inventions to which the four preceding patents refer, in actual operation in this city, and are prepared to place them on the list of real improvements; at all events they appear to be founded upon correct scientific principles, and we hope that the test of experiment may show that these principles are well applied. It is probable that a full account of them will hereafter appear in the Journal.

10. For an improvement in the *Art of Spinning Wool*; John Orndorff, Russelville, Logan county, Kentucky, November 10.

The specification of this patent extends over ten pages closely written, and principally devoted to the giving of precise dimensions of every part of the machine; this is a very common error in these instruments, which renders them needlessly long, whilst it details what may be departed from, in almost every case, without affecting either the principle or the action of a machine.

This instrument is intended as a domestic spinner, and in its general structure resembles numerous others, contrived for the same purpose; the patentee has not claimed any thing, or in any way in-

licated the part in which his improvement is contained; of course what he intended to patent remains unknown, excepting it may be to himself.

11. For an improvement in the *Throstle for Spinning Cotton*, applicable also to roving cotton, and to roving and spinning flax, hemp, wool and worsted, &c.; Samuel Blydenburg, New York, November 10.

The improvement here claimed, is similar to patent 13, for October, noticed at page 27, as a modification of the revolving ring originally patented by Mr. John Thorp, of Providence, Rhode Island. The specification begins by informing us that "this improvement consists in dispensing with the flyers from the spindle, and substituting in place thereof the apparatus below specified."

"That which I claim as my invention, and constituting this my improvement, is the method of *taking up*, as it is technically called, or winding up the thread upon the bobbin, as it is delivered from the rollers and twisted by the turning of the spindle and bobbin."

"This I effect by means of a small ring, which revolves round the spindle and bobbin concentrically with the same, and running loosely in the grooved edges of three or four little friction pullies or shieves, which friction pullies or shieves run, either on male centre points above and below, or on pins standing vertically, and parallel to the spindle," &c.

The greatest difficulty which an inventor has to encounter, is that of so guarding his claim as to secure to himself the *principle* of his discovery. There are so many ways in which the same principle may be varied, that it is impossible for one man to think of, or one instrument to describe them all. In one sense of the term principle, it may be claimed, and the claim sustained; that is, in the sense in which it conveys only the idea of a new mode of action, susceptible of many modifications. An abstract principle, as it exists in nature, is not the subject of a patent. How far Mr. Thorp may have secured his principle, is a point which we shall not agitate.

12. For an improved *Shingle Machine*; Simeon Wood, Holden, Worcester county, Massachusetts, November 10.

Circular saws are to be used in this machine, as in several others which have previously been patented. The construction of the machine cannot be understood without drawings; the general arrangement, however, appears to be good, and to differ materially from either of those which we have heretofore examined.

It is proposed to use two circular saws moved by one drum, and each of these saws is to cut two shingles at the same time. The advantages stated by the patentee to result from the use of his machine, are, that "several saws may be worked in one frame. Each saw cuts, at one operation, two shingles. The carriages which contain the blocks are moved up and down by gearing. The method of setting the block is exact, and makes all the shingles of like thick-

ness, without waste of timber. The cut of the saw is with the grain of the timber, making the shingles more smooth, and less liable to decay. It saws blocks of irregular surfaces, there being no occasion of a flat side."

The points claimed as new, are, the method by which two blocks are sawed at the same time by one saw, and its cutting the timber with the grain. The construction and adaptation of vertical carriages to this purpose. The method employed for confining the block in its place, and setting it at each end, for a but and point alternately.

13. For a churn, called the *Oval Churn*; John Oathoudt, Lebanon, Madison county, New York, November 10.

In this oval churn are two upright shafts with slats, or dashers; the slats of one passing in the spaces between those of the other. These shafts are turned in opposite directions by a wheel with cogs, or pins, on each face, working into pinions on the upper ends of the shafts.

Similar dashers, it may be recollected, were described by us long since, but they are not claimed as new, excepting by inference, in which case every part of this churn is so likewise, as we are not told in what the invention, or novelty, consists.

14. For an improvement in the art of *Distilling the Meal of Maize, or Indian Corn*; Anthony Doolittle, Ypsilanti, Washington county, Michigan Territory, November 10.

The patentee describes his particular manner of producing fermentation, which, as it is probable he may not think it for his interest, we shall not at present publish.

He states that when the fermentation is completed in the manner directed, "a beautiful limpid oil, to the amount of about half a gallon, or one pint to a bushel of corn, will be found floating on the surface of the beer, or liquor, in the tub." This is to be skimmed off, and distillation effected in the usual way, when from four to six quarts more of whiskey will be obtained from every bushel of meal, than by any process heretofore known, and of a greatly improved quality.

"Now what I claim as new, and as my own invention, is the procuring of the oil above specified by the fermentation of the meal of maize, or Indian corn, and thereby increasing the quantity and improving the quality of the spirit, or whiskey, on distillation."

We will only add, as regards the oil, that "there are more things in heaven and earth than have been dreamed of in our philosophy."

15. For a machine for *Turning the Locks in Stove Funnel*, tin ware, or copper ware, and for forming the article; Oliver Hubbard, Claremont, Sullivan county, New Hampshire, November 12.

The workers in copper, tin, and sheet iron, know that several

different machines have been made for turning the edges, to form the grooves upon their work, and for bending the sheets into a cylindrical form. The present, as the title indicates, is an addition to this number. The drawing accompanying the specification, does not very clearly represent the machine; there are, however, two cylinders, on one of which there are plates extending from end to end, forming a groove into which the edge of the sheet is to be put, when by a slight turn it is bent over; the other edge may then be placed in the groove in the same manner, and the cylinder turned until the proper curvature is given to the sheet.

No notice is taken of any other machine, no statement made of what is new in this, and, consequently, nothing claimed.

16. For a machine for *Riving, Jointing, and Squaring Shingles*; Parke Jones, James city county, Virginia, November 12.

For riving the butts, there is a gang of knives, or frows; six of these are represented in the drawing as connected together. These frows have in each end a hole of about an inch in diameter, through which to pass an iron bar. Between each knife there is a ring, or washer, to preserve them at the proper distance apart. With this a number of shingles are to be split out at one operation.

To dress the shingles, a strong frame, or bench, is placed horizontally. A lever ten or twelve feet long turns upon a pin at the back edge of the bench; this lever is to be moved backwards and forwards by hand. On the under side of it, and just over the middle of the bench, a knife of sufficient length, width, and thickness, is bolted. The shingle to be dressed is laid upon the bench in a suitable cavity, and the knife passed over it. By means of a treadle the shingle is then raised, turned over, and the other side dressed. Several are then to be put edgewise, side-by side, into a box, under the knife, and the edges dressed. Their butt ends are then passed through a mortise, and the knife in like manner passed over them.

The claim is to "the construction of the above described machine with the combination of its various parts."

17. For *Machinery for Washing Clothes*, and all kinds of cloth, &c., and for smoothing the same; Eleazer Berry, Bethel, Windsor county, Vermont, November 12.

A frame is to be made to contain two cylinders, one over the other. The whole is to be formed so as to fit into a washing tub, or box, the upper cylinder is to bear upon the lower by means of weighted levers. The clothes are to be passed between the cylinders, which are to be turned back and forth by means of a crank. We are told that it will also serve the purpose of a mangle.

The cylinders, or rollers, with their rotary motion, for the purposes specified, constitute the claim.

18. For an improvement in *Mills for Grinding, Washing, and Separating Gold and Silver* from ores, earth, or in whatever

state these metals may be found. Patented February 13th, 1828. Patent surrendered, and re-issued November 18th, 1829.

The amended specification of this patent is of great length, and is accompanied with six separate drawings. Should all the points claimed in the subjoined formidable list prove to be new, the patentee may be fairly set down as a great inventor, or discoverer.

"I claim as original, the manner of applying the moving power to the shaft of the mill for grinding gold ores, &c. above the runner, by means of iron bevil wheels, or a wooden trundle head and spur wheel, as by this means any number of these mills may be geared to a large horizontal spur wheel, or upon a horizontal shaft upon which bevil wheels are fixed, which may be turned by a large water wheel, or by steam power."

"2nd. The manner of constructing the bed stone to this mill."

"3d. The manner of constructing the iron bed of this mill, and its application."

"4th. The manner of placing the gudgeon in the bed."

"5th. The upright post, in the end of which is fixed the gudgeon."

"6th. The manner of placing the ink in the foot of the perpendicular shaft."

"7th. The sliding board, or regulator."

"8th. The manner of applying a moveable body to the body of the axle, so that the axle may be raised or depressed at pleasure."

"9th. The opening in the side of the shaft, communicating with the long mortise in the same, for the axle to run in."

"10th. The removal of the runner close to the body of the shaft, by which means it rolls and *slides* in a very small circle."

"11th. The long body in the mortise of the shaft, against which the axle rests."

"12th. The tube for conveying the water upon the round part of the axle within the mortise."

"I claim as original the application of the second mill, and the purposes for which it is used."

"I claim as original the wooden runner, or wood banded with iron in the manner described."

"I claim as original the third mill for grinding gold ores in water."

"I claim as original the tipping box, and the purposes for which it is used."

"I claim as original the fourth mill, and the purposes for which it is used."

On comparing the present specification with that accompanying the patent of 1828, we find so little resemblance, that we never should have suspected one to be a mere amendment of the other. When a patent is surrendered, and a new one taken for *the same thing*, it appears to us that the thing ought to be *the same*; that there should be no new claim, but, merely, a more clear exposition of what was intended to be described and claimed originally. If any thing altogether new has been devised, a patent should then be taken for this, as an improvement upon a former machine; a different course certainly renders the security of the new claim doubtful.

19. For a *Washing Machine*; Charles D. Wright, East Had-dam, Connecticut, November 19.

A shaft, furnished with several cranks, works beaters, or stampers, which extend from the cranks in a sloping direction to the further end of a box, or trough, where they are to hammer the clothes until they are clean.

There is no claim.

20. For *Faggoting and Making Anchors*; James Tucker and John Judge; Washington City, November 19.

The specification informs us that "this improvement consists in forming the faggots for the anchor of one or two flat bars instead of the square bars formerly used. The bars required to make the anchor are drawn to models, which, when completed and faggoted, form the exact shape of the component parts of the anchor, whereby consolidation only is required to render the parts ready for welding together to form the anchor. These faggots consist of bars requiring one or two to form a breadth; if of two bars of an irregular width, they are so arranged, (the broad and narrow bars being placed on each other alternately,) that the only joint through the middle of the shank becomes broken."

The claim is to the shape of the bars and the manner of faggoting them, so that they form the throat, crown, and scarphs, dispensing with the several intricate pieces requisite in forming them by the usual method of making anchors."

"The advantages derived from these improvements are as follows. 1st. The bars being placed on edge, in the directions of the strains, obviously increases the strength of the anchor. 2nd. The welds not being more than three, (as the faggoting of the shank and arms forms the throat and crown,) reduces the expense to 35 per cent. less than the common way of making anchors, in addition to the great strength it possesses over those made by the usual method."

The drawings which accompany the specification exemplify the mode pursued. Of its superiority we have no doubt, as every bar used in forming the largest anchor extends to the surface, and must, there at least, be firmly welded, whilst in the old mode it is well known that the surface frequently forms a case only for bars in the inside, which are perfectly detached from their fellows.

21. For an improved *Stereotype Plate*; Nathan Hale, Boston, Massachusetts, November 20.

The improved plate is intended for maps, and other subjects in which drawing and lettering are combined. Blank type, quadrets, or spaces, are to be cast of the usual height of type, so that when set up they will stand even with the face of the letter. These are to be set by the compositor with the required names standing in their proper places; from this a block is to be cast in the usual way of

forming stereotype plates, when the lines of the map, or other drawing, are to be formed by the graver.

"The invention claimed as original consists of the union of the lettering and such parts of the cut as are formed by casting, with the blank parts of the same plate, having an even surface, on which other parts of the same map, or drawing, may be formed by engraving; and in an improved stereotype plate formed as herein before described."

22. For *Manufacturing thoroughly Carbonated Steel*; Stephen Pope, New York, November 20.

The plan proposed, is, to mix together prescribed quantities of charcoal from wood, animal charcoal from leather, and horn shavings, common salt, and urine. This mixture is to be stratified in the furnace, with bars of iron; the upper stratum to be covered with sheet iron, upon which is to be placed sand to the depth of eighteen inches, to serve as a packing to the whole; the process is then to proceed in the ordinary way.

The claim is to "the fine salt, which is to be thoroughly mixed with the other ingredients."

How frequently, and how long since, salt has been used as one of the ingredients in making steel, it might be difficult to tell; we have known it used in case hardening in days long gone by, and have published more than one patent in which it was contained among the ingredients employed. In the theory of its operation we see nothing to recommend it; if, however, it be found good in practice, our theory may be sent to Coventry; upon the question of novelty, however, we have no theory, and all the facts are against the present claimant.

23. For a *Chain Wheel*; Joseph Hines and Enoch D. M'Cord, Sandy Hill, Washington county, New York, November 20.

The patentees state, that instead of the two wrought iron chains, passing round cylinders above and below, and upon cogs to sustain the buckets placed between them, they form their buckets partly of wood, with ends of cast iron, in such a way that they form the chain by linking together, or hooking like a clasp. These are to pass over a wheel, or drum, of from two, to four and a half feet in diameter, with proper cogs, or hollows, to receive pins, or projecting pieces, which prevent the chain of buckets from slipping over. No lower drum, or cylinder, is required, the buckets being suspended from above.

"Each bucket being made separate, any number may be taken off in a short time, to avoid back-water, and put on again at pleasure."

"The water may be carried over the wheel, or it may fall into the buckets on the side just above the upper shaft, or below it."

"The improvements claimed, are, the application of cast iron to form the chains. The application of each head of each bucket to form one link of the chain; and the manner of connecting the heads together. The combination of the several parts as a whole in the manner described and specified."

24. For *Propelling Boats* in the water by the application of sculling wheels, or screw propelling wheels; Benjamin Smith, Rochester, Monroe county, New York, November 20.

These paddle wheels are formed like the wheel of a smoke jack, and are to be fixed at the stern, or bow, of the boat, by means of a shaft running through their centres, and worked by any suitable power.

"What I claim as new, and as my own invention," says the patentee, "is the application of wheels of this description to propelling boats in the manner described; they never before having been used for that purpose."

Wheels of the above kind have been patented, tried, and abandoned, long since. It is one of those obvious modes of propelling which has suggested itself to hundreds of persons; could the propellers be made to run in soft clay, whilst the boat floated on water, they might screw her merrily along; when acting on a perfect fluid, the hopes of all who had calculated upon their utility have been disappointed.

25. For an *Anthracite Coal Cooking Stove*; William Davis and R. W. Lord, New York, November 23.

The fire is made in an open grate, with the bars formed in the usual way. The ends and flue part, or throat, above the grate, are of cast iron. The grate slides in, so that the fire stands under an oven, which oven allows the heated air to circulate round it. When fuel is put on the grate, it must be drawn forward. Behind the oven is a box, forming part of the flue, with openings for boilers, &c. "The whole is mounted on scroll legs, on the inside of which, and at the bottom of the grate, are flanches supporting a sliding pan, or hearth, to receive the ashes."

26. For a *Mucilaginous Durable Compound, as a Substitute for Oil* in the mixing of paint; Lawrence J. Vankleek, Poughkeepsie, Dutchess county, New York, November 23.

This being a recipe, the publication of which might interfere with the interests of the patentee, it is omitted.

27. For a *Machine for Washing Clothes*; Roswell Brainerd, Haddam, Middlesex county, Connecticut, November 23.

Hammers of the construction usually employed for fulling, are placed at each end of a box, and are worked by levers. As no part is claimed, and we do not know what part of the machine is new, further description is unnecessary.

28. For a machine for *Moulding Bricks*; John S. Hanna, Mercer county, Pennsylvania, November 23.

We are told that with this machine 144 bricks may be made in a

minute, and that about 8000 may be made in an hour: as it is to be worked by horse power, we suppose that it is intended that this number may be made by one horse. It would be difficult to describe the machine without a drawing, and that which the patentee has furnished is extremely imperfect. The clay is to be ground, or mixed, by knives fixed upon shafts running horizontally in a circular box, in a form which presents no novelty whatever, being similar to those used in potteries. The pressing machine, so far as the drawing and description can be understood, does not offer, in our view, any thing, either special or general, worthy of remark; nor has the patentee appeared to differ from us in opinion, as he has not put in any claim.

29. For an improvement in *Spinning or Throwing Silk, Wool, Cotton, &c.*; Henry Ruggles, New York, November 24.

It will be seen by the subjoined claim, that this patent, as well as those numbered 11, in the present, and 13 in the last number of this Journal, are modifications of Mr. John Thorp's 'Ring groove spinner.' The observations formerly made upon this subject need not be here repeated.

"The particular feature of novelty in the machinery above described, which I claim as new, and of my invention, is, the combination of machinery, or parts of machinery, by which a wheel, or wheels, is made, or permitted, to travel round a spindle, on a lip or lips of metal, or other hard substance placed between the wheel and the spindle, and surrounding it, so as to permit the yarn, or hook, or axle of the wheel, to travel freely round a spindle, without touching the lip, or lips; thus effecting, or permitting a free rotary motion round a spindle without impediment, being an addition to, or improvement on, the before known throstle frame which is commonly used for spinning, being designed as a substitute for the flyers used in that machine."

30. For a machine for *Washing, Scouring, and Fulling Cloth*, and manufacturing the same; thrashing, working hat bodies, making matting, or carpeting, of wool, fur, or other substances; Harvy Slayton, Lockport, Niagara county, New York, November 25.

This, by the title, would seem to be a sort of universal manufacturing machine, yet, judging from the drawing and description, it appears to be one of the most crude and undigested concatenations of weights, levers, wheels, and rollers, which we have ever encountered. It is represented in three forms, two only of which we will notice, as the third resembles one of the others.

A wheel has spokes projecting out, something like those of a common reel; at the end of each spoke is a roller, turning on gudgeons, parallel to that of the wheel; the under part of the wheel revolves through a trough, or bed piece, which is a segment of a circle, the rollers on the spokes pressing upon whatever may be placed on the

bed of this trough. The rollers or cylinders are to be either smooth or fluted, or covered with cogs,—beaters,—or cleets,—or to have pins projecting from them.

In the other machine a succession of such rollers are fixed horizontally on a frame, and rest upon a revolving endless apron; the revolving endless apron is to be kept in motion by means of a rag wheel, and feed hand; the frame containing the rollers having an alternating motion; the feed hand is attached to this frame.

After the title, which tells us what this machine is to do, we hear no more of most of the articles which it is intended to make, or separate; we are told that “the claim is the construction and operation of this machine. The thickness or thinness of the cloth is effected by regulating the size of the rag wheel.”

We do not suppose that any one will be able to tell from our description how cloth, carpeting, hat bodies, &c. &c. &c. &c. are to be made with this machine, as, with the drawing and whole description before us, we are in the same predicament.

It ought to be mentioned that in the horizontal machine, besides the rollers which, we suppose, are intended to felt the wool, there are two others, one of which is “to be fed with colouring so as to colour the cloth,” and passed from thence “to another cylinder, which may be carved in figures so as to stamp it.”

31. For *Guide and Sign Boards*; Stanley Carter, Raynham, Bristol county, Massachusetts, November 25.

“The board is branded with letters, figures, and such ornaments as may be desired, by means of metal stamps cast in the form of such letters, figures, or ornaments; which stamps are heated to a red heat, and applied to the board, when it is dry, thereby making a deep impression on the board.” The claim is to said improvement.

We must doubt the validity of such a patent, as it is merely applying to sign boards, &c. what has been known and used upon barrels, &c. time out of mind. May a blacksmith hereafter burn his name upon his door, as we have frequently seen it done in country shops?

32. For an improved *Door Spring*; Lynus Burwell, Berlin, Connecticut, November 25.

A spring, ten or twelve inches long, is let into the back, or hinge stile, of the door, a long mortise being made in it for that purpose. The spring is fixed firmly at its lower end; its upper end is bent so as to form a hook, which is connected, by a short rod, to a staple in the rebate of the frame. When the door is closed the spring retires towards the bottom of the mortise; when open, it approached the edge of the stile, and acts upon the door.

33. For a *Thrashing Machine*; Thomas G. Owen, Baltimore, Maryland, November 26.

In this machine the grain is to be thrashed by eight or more vertical beaters placed side by side, and lifted alternately by cams, in the manner of stampers. The grain is to be placed upon an inclined floor, behind the beaters, and is drawn forward by being pressed between two fluted rollers, placed one over the other. These feed rollers are turned by a vertical shaft, having a right and left handed screw cut upon it, which gear into toothed wheels on the gudgeons of the fluted rollers, and turn them in opposite directions.

The claim is, "1st. The manner of revolving, feeding or pressure rollers, by means of spiral wheels fixed on their respective journals, and driven by right and left hand screws, or threads, cut around, and forming parts of a perpendicular revolving shaft. 2nd. The manner of thrashing grain, or seed, of any kind, by means of pieces of wood, or metal, lifted up and let fall perpendicularly thereon, the said pieces, or beaters, being raised by cams, or fly wheels, having stud rollers attached to a horizontal axis, revolved by crank or other means, and driven by manual or other power."

34. For *Making Fence of Wire*, or cords, or twine, and in making seines or nets of wire; Chauncey Hall, Meriden, New Haven county, Connecticut, November 27.

In the specification of this patent, there is no claim, and so best, as there is no *novelty* in the *invention*. Fences of wire were common in England many years ago; they were also used in this country, particularly in the neighbourhood of Philadelphia, fifteen or eighteen years since. Messrs. White and Hazard, who at that time had a wire factory at the falls of Schuylkill, not only erected many wire fences, but also formed a wire bridge over the river, in the neighbourhood of their establishment.

35. For an improvement in the *Buckets of Pumps*; David Coon, Mendon, Monroe county, New York, November 28.

"The improvement consists in having attached to the shaft, a bucket, in the ordinary way, which may be either round or square; the sides of the bucket rise above the valve, and against these, and attached to the shaft are springs, constantly pushing outwards. By means of these the bucket is never liable to get out of order, though the tube may alternately swell and contract. These springs act directly on blocks, to which are attached pieces of leather."

The foregoing is the whole of the specification, and we hardly think that there is enough of novelty in the affair to sustain a claim to an exclusive right. We have frequently leathered the buckets of pumps with the leather extending above the valve, depending sometimes upon a spiral spring within the leather, and at others upon the pressure of the column of water to press the leather against the sides of the pump barrel, the body of the piston fitting loosely; and, at the period when we had opportunities of essaying many plans for pistons and valves, Mr. Jacob Perkins constructed a piston which

operated both as a bucket and a valve, and which acted perfectly well; as it descended, the leather of the piston collapsed and allowed the water to rise above it, and as it ascended it was pressed out by a spring, so as to occupy the area of the cylinder.

36. For a *Churn*; Hosea H. Grover, Auburn, Cayuga county, New York, November 30.

Eleven pages are occupied with the description of this important instrument, and ends with the following brief claim, "the application of the tapering tub, in connexion with the other apparatus, to churn, or mash."

A frame is made to support a vertical crown wheel, which meshes into a pinion on the shaft which carries the dashers; various modes of forming these are described, and either of them, we have no doubt, will produce good butter from good cream.

37. For an improved *Paddle for Propelling Steam and other Vessels*; Jacob Perkins, Civil Engineer, a citizen of the United States, but now of London, in England, November 30.

We have already published some observations upon Mr. Perkins' paddle wheel, and will, in an early number, give the specification with engravings.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On the power required to propel Carriages on Rail-roads, compared with that for moving boats in Canals. By JAMES P. ESPY.

THERE is not, I believe, any subject connected with the arts which presents higher claims to public attention than that of rail-roads; a subject which has been recently treated in an able and perspicuous manner, in a work which deserves to be most particularly recommended to the notice of practical men; the "Rail-road Manual, or a brief exposition of principles and deductions, applicable in tracing the route of a rail-road. By S. H. Long, Baltimore, Lieut. Col. Engineers, in the service of the Baltimore and Ohio Rail-road Company." In two neat little volumes, published in Baltimore, in September last. The talents, the practical acquirements, and the zeal of Col. Long in the public service, are too well known to need any eulogium from me. Every one desirous of information respecting rail-roads, should consult this work; there is one point respecting these structures, which ought to be pressed again and again on the attention of the public, until they are fully aware of the immense advantages rail-roads offer over every other mode of conveyance.

It is known to men of science, that it has been proved, by the most unexceptionable experiments, that the friction of a carriage on a well constructed rail-road, is not increased with an increased velocity; or, in other words, that the tension of a rope with which a

carriage on a rail-road is drawn at one time, with a uniform velocity of 20 feet per second, at another with a uniform velocity of 40 or 100 feet per second, is the same; whilst the tension of a rope drawing a canal boat is 4 times as great with a double velocity, 9 times as great with a triple velocity, and 100 times as great for 10 times the velocity, and, indeed, a little greater, as is clearly shown by some very late and beautiful experiments by Mr. Walker, detailed in the last volume of the *Transactions of the Royal Philosophical Society*; that is, the resistance increases in a higher ratio than that of the square of the velocity.

Now it has been shown by Mr. Wood, (in his work on canals and rail-roads,) that the resistances on canals and rail-roads are equal, with a velocity of $3\frac{1}{2}$ miles an hour; amounting to about one pound of resistance for every 200 pounds of load: and, according to this ratio, he has calculated, that with a velocity of 6 miles an hour, 3 times as many horses would be required to do the same quantity of work on a canal, which would be required on a rail-road. But, when the new rail-road carriage, invented by Winans, shall be introduced, the resistance may be fairly calculated not to exceed one pound to a thousand, or one-fifth of the quantity allowed by Mr. Wood. According to this ratio, the resistance on a canal would be equal to that on a rail-road, with a velocity on the former of $1\frac{6}{10}$ mile per hour; a double velocity, or $3\frac{1}{5}$ miles per hour, will give four times the resistance on the canal; ten times the velocity, or 16 miles, will give 100 times the resistance; and 20 times the velocity, or 32 miles, (the greatest velocity which locomotive engines have been made to move in Great Britain, would give the enormous resistance of 400 times, in favour of rail-roads. And this is calculated on the supposition that the resistance on canals increases only in proportion to the squares of the velocities, when, in fact, (especially if the canal is narrow and shallow,) it increases in a higher ratio, whilst that on rail-roads is the same at all velocities.

For example, suppose the power to be estimated by the quantity of coals consumed in transporting a given weight with the various velocities mentioned above, it will be found, if the velocity is one mile and six-tenths per hour, the quantity will be the same on the canal as on the rail-road; whereas, if the velocities are 16 miles an hour, the quantity consumed on the canal will be 100 times greater for every mile and one-sixth, while that on the rail-road will remain exactly the same. Now when it is recollected that a very great velocity cannot be obtained at all on canals, and that a velocity of 20, or even 30 miles per hour, can be obtained on a rail-road, with no greater expenditure of coals per mile than would be required on a canal with a velocity of $1\frac{6}{10}$ miles per hour, we may predict, with the greatest confidence, that canals, in a few years, will be entirely supplanted by rail-roads.

This subject should be well studied by public functionaries, lest, at the very moment when canals are about to become obsolete, they ignorantly spend the public money on what, in a few years, will be of no use.

Philadelphia, February 1, 1830.

On Improvements in Effacing in Lithography.

From *Bulletin de la Soci  t   d'Encouragement*, Nov. 1828.

THE power of *effacing* any part of a design, and of *retouching* it again at pleasure, was one of the most desirable ameliorations in lithography. Two different and opposite means have now conducted to this happy result. The first, and which would naturally present itself to any person conversant with chemistry, consists in the employment of an *alkali*, to dissolve the fatty and viscous materials, by means of which the printing ink attached itself. It is in this manner that MM. *Chevalier* and *Langlume* have resolved the problem, and their success is a new proof of the advantages which result from combining theory with practice. These gentlemen have already published their discovery, in a complete work of their composition; and which has not a little contributed to the progress of lithography.

The other process was contrived, by uniting two different methods; and was also the result of practical observation: namely, the employment which is daily made of an acid, more or less strong, to remove the spots which form themselves upon the margins of the lithographic stones, in printing from them, gave rise to the supposition, that a *vegetable acid*, which should exert but little action upon the stone, would yet suffice for completely effacing all the fatty parts, and thus permit us to make all manner of changes on the places thus perfectly cleansed. This conjecture has been confirmed by the fullest success. The following is the manner of executing this mode of effacing:

We commence, then, by first removing, with *essence of turpentine*, the ink, or the traces of the crayon, from the part where we would change the subject; we then apply, with a hair-pencil, a little *vinegar*. The acid is then removed with a sponge moistened with water; and when the place has become dry, it may be retouched with the same facility as upon a new stone. This process, by means of the vinegar, is a rather quicker and more convenient one for the removal of *writing* from the stone. But in other cases, the employment of *alkali* is more advantageous; it is, in fact, only experience which can determine in which case either of the methods should be used; and, indeed, there are some cases in which either method may be indifferently employed.

[*Technological Repository.*

LIST OF ENGLISH PATENTS

Which have passed the Great Seal, from March 26, to June 19, 1829.

To William Church, Esq., for certain improvements in buttons, and in the machinery or apparatus for manufacturing the same—March 26.

To William Madely, Farmer, for an apparatus or machine for catching, detecting, and detaining, depredators and trespassers, or

any animal; and which he denominates the Humane Snare—March 28.

To Josias Lambert, Esq., for an improvement in the process of making iron, applicable to the smelting of the ore, and in various subsequent stages of the process, up to the completion of the rods or bars, and also for the improvement of the quality of inferior iron—March 30.

To William Prior, Gentleman, for certain improvements in the construction and combination of machinery for securing, supporting, and striking, the top-masts and top-gallant-masts of ships, and other vessels—April 11.

To John Lihon, a Commander in our Royal Navy, for an improved method of constructing ships' pintles, for hanging the rudder—April 14.

To Benjamin Cook, Brass Founder, for an improved method of making rollers or cylinders of copper, and other metals, or a mixture of metals, for printing of calicoes, silks, cloths, and other articles—April 23.

To James Wright, Soap-maker, for improvements in condensing the gas or gases produced by the decomposition of muriate of soda, and certain other substances, which improvements may also be applied to other purposes—April 28.

To Peter Pickering and William Pickering, Merchants, for an engine or machinery, to be worked by means of fluids, gases, or air, on shore or at sea, and which they mean to denominate Pickerings' Engine—April 28.

To John Davis, Sugar Refiner, who, in consequence of a communication made to him by a foreigner residing abroad, is in possession of a certain improvement in the condenser, used with the said petitioner's apparatus, for boiling sugar in vacuo, for which a patent was granted to him the 29th day of March, 1828, entitled an improvement in boiling or evaporating solutions of sugar and other liquids—April 28.

To Henry Robinson Palmer, Civil Engineer, for a certain improvement or improvements in the construction of warehouses, sheds, and other buildings intended for the protection of property—April 28.

To George William Lee, Merchant, who, in consequence of a communication made to him, by a certain foreigner residing abroad, is in possession of certain improvements in machinery, for spinning cotton and other fibrous substances—May 2.

To Henry Bock, Esq., who, in consequence of a communication made to him by a certain foreigner residing abroad, is in possession of improvements on machinery and apparatus for embroidering or ornamenting cloths, stuffs, and other fabrics—May 2.

To James Dutton, jun. Clothier, for certain improvements for propelling ships, boats, and other vessels, or floating bodies, by steam or other power—May 19.

To Maxwell Dick, Bookseller and Publisher, for an improved railroad, and method of propelling carriages thereon by machinery, for

the purpose of conveying passengers, letters, intelligence, packets, and other goods, with great velocity—May 21.

To Thomas Robinson Williams, Esq., for improvements in the making or manufacturing of felt, or a substance of the nature thereof, applicable to the covering of the bottoms of vessels, and other purposes—May 23.

To Thomas Arnold, Tin-plate Worker, for a new or improved machine or gauge, for the purpose of denoting the quality of fluids, or spirituous liquors, and for measuring or denoting the quantity of fluids or spirituous liquors withdrawn from the vessels or receptacles in which the same are contained, and which machine or gauge may be so constructed, as to affect either of the above objects, without the other, if required—May 26.

To William Poole, Smith, for certain improvements in machinery for propelling vessels, and giving motion to mills, and other machinery—May 26.

To Charles Turner Sturtivant, Soap-boiler, for certain improvements in the process of manufacturing soap—May 26.

To Joseph Cliseld Daniel, Clothier, for certain improvements in machinery, applicable to dressing woollen cloth—May 26.

To Ross Winans, for certain improvements in diminishing friction in wheel carriages, to be used on rail and other roads, and which improvements are also applicable to other purposes—May 28.

To William Mann, Gentleman, for his discovery, that by the application of compressed air, power and motion can be communicated to fixed machinery, and to carriages and other locomotive machines; and also to ships, vessels, and other floating bodies—June 1.

To Andrew Gottlieb, Locksmith, for certain improvements on, or additions to, locks and keys—June 1.

To John Smith, Corn-miller, being one of the people called quakers, for certain improvements in machinery for dressing flour—June 1.

To Charles Brook, Cotton Spinner, for certain improvements in machinery for spinning cotton, and other fibrous substances—June 4.

To Robert Porter, Iron manufacturer, for a certain improvement or improvements in iron heels and tips for boots and shoes—June 13.

To Francis Day, Optician, and August Münch, Mechanic, who, in consequence of a communication made to them by a certain foreigner residing abroad, and inventions by themselves, are in possession of certain improvements on musical instruments—June 16.

To Charles Wheatstone, Musical Instrument-maker, for a certain improvement or improvements in the construction of wind musical instruments—June 19.

To Moses Poole, Gentleman, who in consequence of a communication made to him by a certain foreigner residing abroad, is in possession of certain improved machinery for kneading dough—June 19.

JOURNAL
OF THE
FRANKLIN INSTITUTE
OF THE
State of Pennsylvania;
DEVOTED TO THE
MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,
AND THE RECORDING OF
AMERICAN AND OTHER PATENTED INVENTIONS.

MARCH, 1830.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an Improved Cooking Grate, and its Appendages; intended chiefly for cooking by means of Anthracite Coal. Granted to THOMAS VINTON, of Philadelphia, Pennsylvania, October 31, 1829.

BE it known that I, Thomas Vinton, of the City of Philadelphia, in the State of Pennsylvania, have made certain improvements in the cooking grate and its appendages, intended, chiefly, for cooking by means of anthracite coal, and that the following is a full and exact description of the same, reference being had to the drawing which accompanies this specification, and which makes part thereof.

The general construction and form of the grate may be the same as those in ordinary use, and it is to be lined with fire brick, in the usual manner; considerable variation, however, may be made in the arrangement of those parts which I esteem as new, without, in any degree, varying the principle upon which my improvements are founded.

Fig. 1, in the accompanying drawing, (Plate 1,) is a perspective view of the grate, set in a common fire-place, the brick lining being omitted for the purpose of more perfectly showing the parts formed of iron.

Fig. 2, is a plan, the same letters of reference being employed in each to designate similar parts.

A, is an oven on one side of the grate, and B, a boiler on the opposite side.

C, C, are boxes formed of cast iron, with small grates, or bars,

exposed to the open fire, to admit heated air, which passes into the spaces that surround the oven and the boiler.

D, D, D, are pipes, with registers, for conveying off the heated air from the oven, and the air chambers.

At E, are two openings for the admission of cold air; through one of these it passes into the cast iron tube, F, which is, on one side, exposed to the direct action of the fire, as it stands flush with the fire brick, in its passage through the grate: this tube opens into the oven at G; through the other opening cold air passes into the air chamber, R, behind the fire, where it becomes heated, and is admitted into the back part of the oven at S. To allow of the escape of the heated air, the short pipe having its opening at H, communicates with the oven, whilst the larger pipes, in the back angles, open into the air chambers which surround the oven and the boiler, and extend up the chimney, five or six feet; these establish a draft through the grates in the boxes, C, C, and the air chambers. The portion of ashes which may be drawn in through the grates, may be removed at the ash pit doors, I, I, which are made to fit closely, to prevent the admission of cold air; and the registers, J, J, J, in the heated air pipes, serve to regulate the draft through them, with the utmost facility. The cock, K, is for drawing water from the boiler, which is intended to be kept supplied with water. The cock may be made to unscrew for the purpose of removing the boiler, when desired.

L, L, L, in Fig. 2, are the fire brick, not represented in the perspective view. The boxes C, C, extend within the grate, so that their fronts are flush with the brick, when the grate is lined; this is also the case with the tube F.

M, is a sliding blower, which, although not necessarily appended to the fire-place, is of great utility.

N, N, N, are the bars of the grate; the basket part being omitted in order to show, more perfectly, the boxes C, C, and the tube F.

O, O, are the stiles which connect the ends of the bars of the grate; there being spaces without these stiles, to allow for the expansion of the bars, by heat.

P, P, are perforations in the back plate, and in the hearth; the perforations in the back plate, are for the admission of heat through the plate, and to allow of the expansion and contraction of the plate, with less danger of fracture than when solid.

Q, is an aperture leading from the fire, to the space over the oven, and which may be closed at pleasure.*

R, is an air chamber at the back of the grate, which is distinct from the chambers that surround the boiler and the oven; the latter being, in general, situated at the outer side, and above and below, but it may be extended to the back, and to the side exposed to the fire, if preferred.

The grate, with its appendages, is to be placed in an open fire-place, with a crane for the purpose of hanging kettles, &c. in the usual manner, whilst meat may be roasted in front, without interfering with the other operations.

* The letter Q, is omitted in the engraving.

What I claim as new, and as my own invention in the above described grate, is the pipe F, with its openings, and the chamber R, by which air, heated by the fire, is admitted directly into the oven; and also the boxes C, C, with their openings, for admitting the air, which has been heated by passing through the fire into the spaces surrounding the oven, by the aid of which the operation of baking is readily and perfectly effected.

THOMAS VINTON.

References to the Drawing of Thomas Vinton's Cooking Grate, Plate 1.

Fig. 1. Perspective view of the grate, set in a common fire-place; the fire bricks at L omitted.

Fig. 2. Plan of the grate.

A, oven.

B, boiler.

C, boxes containing small grates admitting and conducting heated air from the fire around the oven and boiler.

D, pipes with registers.

E, openings for cold air, one communicating with the oven at G, through the tube F, and passing out at the pipe H; the other communicating with the air chamber R.

I, doors to ash pits.

J, registers.

K, cock communicating with the boiler.

L, fire bricks.

M, sliding blower.

N, bars of the grate; the basket part omitted to show the boxes and tube.

O, stiles connecting the ends of the bars.

P, perforations in the back plate and hearth.

Q, aperture leading from the fire to the space over the oven.

R, air chamber communicating with the oven at S.

Remarks by the Editor.—Experience, the best test of the worth of either persons or things, has, so far as it has come to our knowledge, been altogether in favour of the apparatus above described. An intimate friend in Philadelphia, whose family is large, and in whose word and judgment we have entire confidence, has had Mr. Vinton's grate in use for some time, and is too well pleased with it to be willing to return to the wood fire for the purpose of cooking, or, indeed, to any other mode with which he is acquainted. At a very early period this grate achieved a signal triumph in his family; it not only silenced the opposition made to the trial of it, by the occupants of the kitchen, but has converted them into zealous advocates, as they find it to answer the purposes intended in a very perfect manner, whilst it possesses that valuable attribute of an anthracite coal fire, the requiring so little attention to keep it up.

Meat baked in the oven, we are assured, cannot be distinguished, by the epicures, from that roasted before the fire; the surface is well browned, and the gravy unburned. Bread, and the various ar-

ticles of pastry, are baked as well as in a brick oven, the heated air communicating a much more equable temperature to the plates of the oven, than a direct fire. We have not, ourselves, seen the grate in operation, or tasted of the savoury viands which it sends forth, we should not, therefore, have ventured a decided opinion in its favour, had not its character been furnished by those who have no personal interest in bringing it into notice.

Those grates which have hitherto been put up, have not been furnished with boilers. With the appendages, such as bars of wrought iron to place kettles, &c. above the fire; a trivet, or shelf, in front of the grate, and the fire brick; the cost of them is thirty-five dollars. When a boiler is added, this of course will increase the price in proportion to its size, and the material of which it is made, as of tinned copper, or iron. The cost of a sliding blower, and the work in fixing it, is not included, as not being essential to the use of the grate. The quantity of coal used is said to be about the same as that for an ordinary parlour grate.

Mr. Vinton has published the subjoined directions, for the use of those who employ his cooking stove.

“Directions for making a Coal Fire, and for using the Cooking Apparatus.

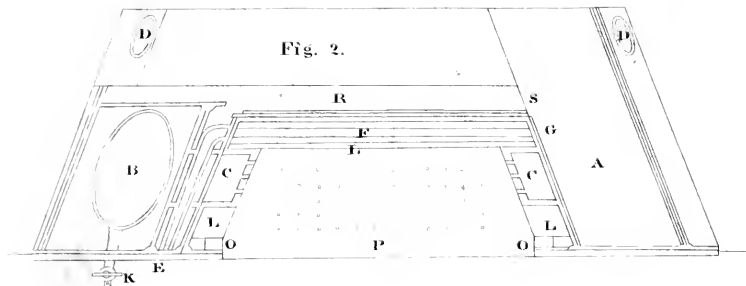
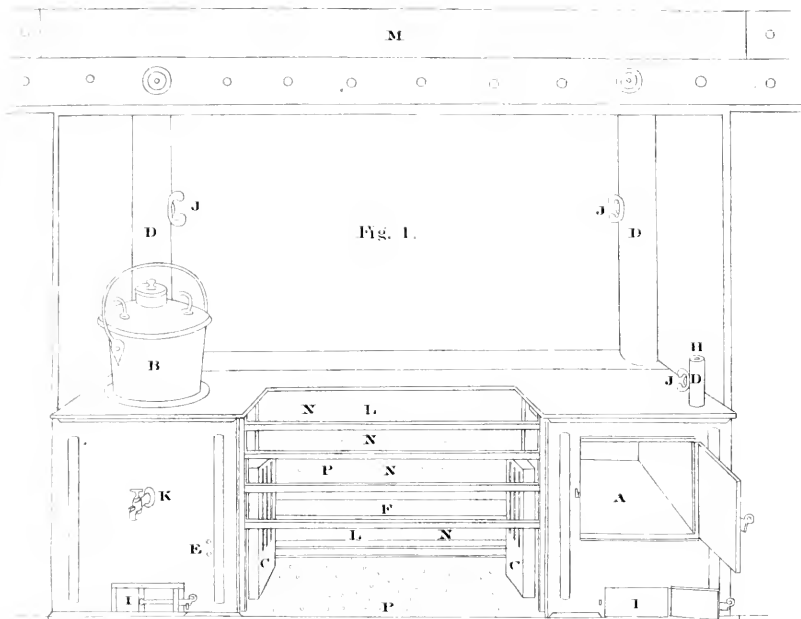
“1. Anthracite coal, when broken into pieces from the size of a hen's egg to that of a common sized tea-cup, and free from dust, will burn freely, without the aid of a *blower*, if left to kindle, and but a small quantity of coal is added at a time. The fire also, will, in this case, be much clearer and stronger.—Dry wood, or charcoal, should be used for kindling it.

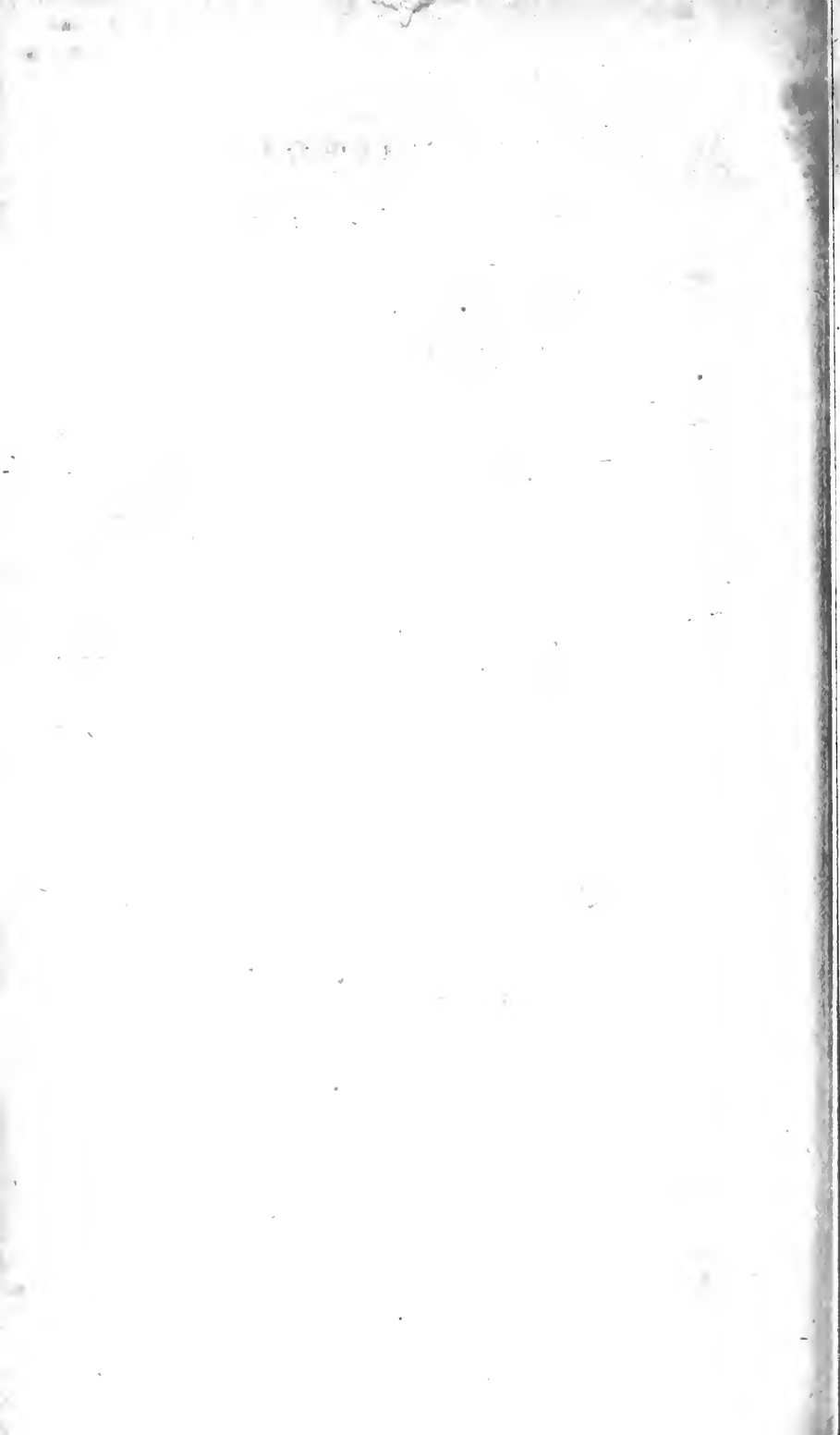
“2. The blower will facilitate the kindling of the fire in the morning, and at other times when it is low, *but it should be used sparingly*; for when used but a short time, the heat becomes so intense as to melt the ashes and stony substances found in the coal, and form a cement, which prevents the free circulation of air, and the fire soon becomes dull and sluggish. Whenever this is the case, the whole mass should be broken up, by putting the poker under the basket part of the grate, between the bars, and lifting the coal; or by passing it between the front bars and prying the coal up. The first method is the best; as it not only lightens the coal, but frees the grate from ashes. The looser the coal lies in the grate, the brisker will be the fire.

“3. Should the fire become dull, after the coal is ignited, *it is a sure indication that it is clogged* with the cement before mentioned, with ashes, or coal dust, or that there is too great a quantity in the grate; in either case, instead of running down the blower, which will only increase the difficulty, free the grate in the manner directed in the foregoing section.

“4. For roasting or baking, *it is necessary that a large proportion of the heat should be in the basket, or lower part of the grate*; keep that part, therefore, free from slaty and stony substances, and from the remains of melted cement, or these will, in a short time, when

VINTON'S COOKING STOVE





the coal is very impure, occupy the space which should be filled with pure coal and active heat. The pieces of slate, stone, or cement, which are too large to fall through the grate, should be taken out with tongs.

"5. Permitting water to boil over, or to be spilled on the fire bricks, will cause them to crumble, and should it reach the cast iron pipe between them, in the back part of the fire-place, or the small grate at its end, it may cause them to bend or warp. Exposing them when heated, to the action of cold air, will also have the same effect, and it is, therefore, necessary that the fire go out gradually, and never be taken all out at once.

"6. For all the purposes of a common family, it is not necessary to have more coal in the grate than will come to a level with the second bar from the top. A larger quantity is a useless and injurious weight, which presses that below it so closely together, as to prevent a free circulation of air. Putting cooking utensils or other weight on the fire, will also deaden it.

"7. A small quantity of coal, in pieces about the size of a walnut, put on the top of the fire, while baking, will be useful to keep the heat from ascending.

"8. Sprinkling a small quantity of coal dust or ashes, on the fire at night, will preserve it until the next morning, when there will be sufficient heat to kindle fresh coal or wood.

"9. Scrape out the *ashes from the ash pit* every morning.

"10. Whenever the bottom plate of the oven becomes too much heated, the heat can be shut off, in part, or wholly, by altering the register in the flat pipe; in like manner, should the oven become too hot, raise the register in the tube on its top—this will also cause the circulation of heated air through it. A thin fire brick placed on the bottom plate of the oven, will be useful to bake articles on, which are sweetened—this will prevent their being burned.

"11. By lowering the blower to within 15 to 18 inches of the top of the grate, and placing the fender before the fire, the greater part of the heat will be taken up the chimney. The object of this, is, to prevent the kitchen from becoming heated in the summer.

"12. The foregoing directions being attended to, the use of coal will, after a little experience, be found to be preferable to wood, and not one half the labour is requisite to keep the fire in order."

Specification of a patent for a "Pendulous Rail-road Car," for running or moving upon rail-roads. Granted to SAMUEL T. JONES, Philadelphia, Pennsylvania, February 22, 1830.

To all whom it may concern, be it known, that I, Samuel T. Jones, of the City of Philadelphia, in the State of Pennsylvania, have invented an improved car, which I denominate the Pendulous Rail-road Car, for running or moving upon rail-roads, in which are combined, simplicity of construction, facility of being loaded or unloaded,

and of turning upon a curved road; and that the following is a full and exact description of my said invention, or improvement.

The body of the car may be constructed of iron, wood, or any other suitable material, and in any form which may be preferred. This I suspend upon two wheels, which is the distinguishing feature of my invention. In order to effect this, I suspend the car in such way, that whether loaded or not, the centre of gravity of its body, when in its upright and proper position, must be below the point or points of suspension. An axle common to each wheel, and revolving with them, may be made to pass over the top of the car, or through the sides thereof; and in the last named case, should be enclosed within a box or tube, extending from one side of the car to the other, to protect the axle from being obstructed in its motion by the load; or, a frame may be made of wood, or other material, which shall surround the car, so as, on each side, to receive a wheel between two cheeks, so that its axle or gudgeons may be carried and revolve in proper boxes contained in, or attached to, said cheeks; the car being attached to and swinging with the frame, upon the axles or gudgeons as joint bearings. Instead of attaching the points of suspension directly to the sides of the car, I intend, sometimes, to extend a spring, or a bar, along each side of its body, and firmly affixed thereto by its two ends, and to make this spring, or the bar in its central or middle part, the point of suspension; in which case the bar is intended to operate as a spring, and to lessen the vibration of the various parts of the car.

When the car is at rest, for the purpose of being loaded, or unloaded, bolts or props may be made to shoot out, or to turn down, from the ends or sides of the body of the car, and to rest either upon the rails, or path, so as to hold the body steady; these, when desired, may be made to project sufficiently to tilt the car towards either end, and thus bring it nearer to the ground, to facilitate the loading or unloading. These props may be constructed in various ways, two of which are shown in the drawings deposited in the patent office.

The wheels of these cars may be made five or six feet in diameter, and still the load may be lower down than in ordinary rail-road carriages, or even more than this, and the same purpose be effected.

The cars may be attached to each other, so as to form a train, by bars or chains, in the usual way, but in order to lessen their vibrating, or pendulating, upon their points of suspension, when in progressive motion on the road, and to increase the steadiness of the wheels upon the rails, I intend, in general, instead of chains, to attach them by a clevis, which shall work in loops, or eyes, in the ends of the cars, so as to allow of a horizontal hinge motion, at one end of the clevis, and permit the cars to turn readily upon a curve in the road, thus acting like the bolt in the bed of an ordinary carriage or wagon.

Friction wheels of the various forms now in use, may be employed and attached in the ordinary way, which, making no part of my invention, I do not describe. What I claim as new in the above described cars, is the adaptation of a two wheeled vehicle to a rail-road,

by suspending the body of the car, and its load, so that the centre of gravity may be below the points of suspension, and the car thereby made to hang in an upright position by its own weight; of being tilted towards either end for the purpose of greater facility in loading or unloading, and answering other useful ends.

SAMUEL T. JONES.

References to the Drawings of Samuel T. Jones' Pendulous Rail-road Car, Plate 2.

Fig. 1. The flanches are here supposed to be on the inner edges of the wheels, and the wheels running in a frame, *a, a, a, a*, without an axis common to both wheels. *b, b*, bolts or props, to steady, or tilt the car, whilst loading or unloading.

Fig. 2. In this the axis crosses the car, and is boxed over. *d, d*, show sliding bolts or props, to answer the purpose of those at *b, b*, Fig. 1.

Fig. 3. Is a form in which the clevis, to connect the cars, may be made; the three shanks dropping into tubes, or loops, two into one, and one into another car. The loops are seen at *e, e, e*, Figs. 1 and 2.

Specification of a patent for modes of adapting Rail-way Cars, or Carriages, to run on ordinary roads or streets, and also of enabling Carts, Wagons, and Carriages of various kinds, to run securely upon rail-roads. Granted to SAMUEL T. JONES, of Philadelphia, Pennsylvania, February 22, 1830.

To all whom it may concern, be it known, that I, Samuel T. Jones, of the City of Philadelphia, in the State of Pennsylvania, have invented a new and useful mode or modes of adapting rail-way cars, or carriages, to run on ordinary roads or streets, and also of enabling carts, wagons, and carriages, of various kinds, to run securely upon rail-roads; and that the following is a full and exact description of my said invention.

The main difficulty in converting a rail-road car or carriage into one for common roads, is the structure of the wheels, which, on rail-roads, require flanches, or some substitute therefor, which renders them unfit for other roads; and, in like manner, carriages for ordinary roads, for want of these appendages, will not run upon rail-roads. To obviate these difficulties, I have invented and adopted the following plans, which may be applied either to my pendulous rail-road car, or to any other car, or carriage, for rail-roads.

I sometimes make my wheels without flanches, and instead thereof, use friction rollers fixed upon, or adapted to, suitable arms or bearings, extending down to the rail, so that the rollers may bear against its side, and perform the office of a flanch. The application of friction rollers is not new, but instead of making the arms, or bearings, or the rollers, fixtures, I construct them so that they may slide up, when the car or carriage is about to pass off the rail-

road, and bring the rollers nearly or quite into contact with the body of the car; or to swivel upon a joint or joints, so as to turn up on the ends of the car or carriage, and in these positions be secured by any convenient means, so that they will not be liable to meet the usual obstructions on the surface of the common roads. These may be fixed in various ways, two of which, deemed by me as among the most eligible, are represented in the drawings deposited in the patent office. Sometimes I construct the axles of the friction wheels, or rollers, so that they may easily be withdrawn from the bearings, and remove the wheels or rollers only, without disturbing the arms or bearings, for said purpose.

The novelty which I here claim, is the attaching the arms, bearings, or axles, which carry the friction wheels or rollers, in such way, as that they can be readily removed, and thus prevented from coming into contact with the ground, which they would if they were fixtures, in their usual acting position, when desired to pass off the rail-way.

Another mode by which I convert the rail-road car or carriage into one for common roads, is by using them with flanches to the wheels, of nearly the ordinary form, but which also are capable of being removed, or unshipped when they are to pass off the rail-road. This may be effected by screws, bolts, buttons, spring catches, or other means equally easy and secure, to which I could lay no claim, my invention being simply the removing or attaching the flanches for the purpose above specified.

It will readily be perceived that in this case, the flanch is to be disconnect and separate from the tire or band surrounding the wheel, which latter is intended to be a fixture. The flanch may be either of cast or wrought metal, but in this, and in all cases wherein the car or carriage is to be adapted for passing off the rail-road, if the wheels are of wood, I recommend the tire or band aforesaid to be of rolled or wrought metal.

A simple and easy mode of securing the flanches to the wheels, and allowing of their removal without loss of time, is the following. A suitable number of holes are to be made in that part of the hoop, or ring, which covers the side of the wheel, and of which the projecting part, when on, forms the flanch. On the side of the wheel, there are to be a corresponding number of hooks, catches, or buttons, which will pass through said holes, so that when the flanch is hung upon them, they will hook or lap over the outer edge of the holes, by the falling of the flanch into the hooks or notches, or catches, prepared for that purpose; a single bolt now passed through the flanch or rim, and wheel, and secured by a nut, catch, or key, will secure the whole firmly together, and also allow of their being separated again with the utmost facility. The hooks, catches, or buttons, may, if preferred, be fixed upon the flanch piece, and pass into holes in the wheel, and there lap into and become tied, and then be secured by a single bolt passing through the flanch or rim, and wheel, as before mentioned. The hooks or catches may themselves be made to take off, when the car or wagon is intended to leave the rail-road.

Where frequent shifting is not necessary, bolts and nuts may be

used, instead of any other contrivance. The hooks or catches before named, may be made to tighten upon the flanch by means of nuts. I do not, however, confine myself to the modes designated, but to secure the flanch by any method by which this can be readily done, and at the same time admit of its easy removal.

In order to adapt common carts, wagons, and other similar vehicles, or pleasure carriages, to rail-roads, when the faces, tread, or tires of their wheels are sufficiently true, and of a proper width to run or move upon rail-roads, I attach either moveable friction wheels, or flanches to them, as above described, and affix them either on the outsides or insides of the wheels, according to the structure of the rail-road on which they are to run.

When the wheels are in any way defective or deficient in the face, or tread, for running upon a rail-road, I place a rim, covering the face of the wheel, and also forming a flanch, so as to enclose and surround the wheel, and give to it the form and attributes of a wheel for a rail-road, and attach and secure it to the wheel by means similar to those already described. In case of a wagon or other ordinary four wheeled carriage being adapted to a rail-road, the fore axle which works upon a pin or bolt, may be secured to the carriage, by another bolt or tie, so as to convert it into a fixed axle.

I intend sometimes to widen the edge of the ordinary flanch, so that when it leaves the rail, the edge shall serve as a tread, or face, for ordinary roads.

What I claim as new, and as my invention or discovery, is the attaching a moveable flanch or flanches, or of shifting friction rollers operating as flanches, to rail-road cars or carriages, in lieu of fixed ones as at present employed, for the purpose of adapting them to rail-roads when the rollers or flanches are in their places, and to common roads when they are removed; and also the attaching of such rollers, and flanches, or a complete rim forming a face, or tread, and flanch to carts, wagons, or carriages, intended for ordinary roads, so as to fit them for running upon rail-roads. I likewise claim the widening the edge of the flanch so as to become a face, or tread, suitable for streets, or common roads.

SAMUEL T. JONES.

References to the Drawings of Samuel T. Jones' Rail-way and Road Carriage, Plate 2.

Fig. 4. *a, a*, the sliding piece sustaining the rollers, *b, b*, which act against the side of the rail.

Fig. 5. *d, d*, pieces which swivel on pins and carrying rollers *e, e*, which may be turned up on the ends of the car, and secured by screws, or otherwise.

Fig. 6. An end view of these pieces, with their rollers connected by the bar *f*.

Fig. 7. A mode in which friction wheels, with bevilled edges, may be applied, and slide up by the bolts *g, g*.

Fig. 8. A moveable flanch with perforations at *h, h, h*, to latch, or catch upon *i, i, i*, in Fig. 9; *k*, in Fig. 8, is a bolt, the shank of

which passes through *b*, in Fig. 9, and is seen at *m*, in the edge view of the wheel, Fig. 10, one of the hooks, or latches, being shown at *n*.

Fig. 11. Shows how the flanch may be widened, so as to become adapted to serve as a face, or tread, on ordinary roads.

Remarks by the Editor.—From frequent conversations with the gentleman who has obtained the two preceding patents, we have been fully informed of the advantages which he anticipates from his inventions. Most of these are apparent from the tenor of the specifications, particularly of that for enabling carriages to run either upon rail, or common roads. In the pendulous car, it is believed, that by substituting wheels of from 5 to 6 feet in diameter, for those of 2 or $2\frac{1}{2}$ feet, as now employed, the motion of the car will be much more steady, and attended with less jolting at the joinings of the rails, as those inequalities will be much more readily surmounted, which, though small, are inseparable from structures of this kind, and produce a perpetual vibration. The friction on the axle will also be decreased in proportion to the increase of the size of the wheel, and the extent of rubbing surface will also be lessened from the cars resting upon two bearings instead of four. The ease of loading and unloading will be greater than in the common car, as, notwithstanding the size of the wheels, its body may be placed nearer to the ground than has heretofore been practised, and by means of the bolts or props, one end be brought into direct contact with it. It is not believed that, on a rail-road, any inconvenience would be experienced from the pendulous motion of a single car. This, however, is a point of little importance, as a single horse would, of course, draw several of them, and the mode of connecting them would prevent all vibration upon their axes, whilst it offers every facility to their adapting themselves to any curve.

The capacity of each car may be nearly, or quite the same as those with four wheels, and from the weight hanging so much below the axle, the lateral strain upon the wheels will be greatly lessened.

Specification of a patent for a Tide Power, or the application of the power of tide water, connected with the principles of Buoyancy and Gravity, for the purpose of applying power to machinery, or any other required use. Granted to HENRY M. WESTERN, New York, December 23, 1829.

THE object which the subscriber purposes to effect, is to bring into value and use the rise and fall of the tide water on the sea board, and particularly in the principal cities of the union, to be employed in manufacturing, and other purposes.

The plan in which this object is to be effected, is by the use, or construction, of vessels, or floats, of great weight and buoyancy, so that, in the instance of the fall of the tide, by their weight, or the weights contained in them, and in the rise of the floats, by their float-

S. T. JONES'S RAIL-WAY CARS AND WHEELS.

FIG. 1.

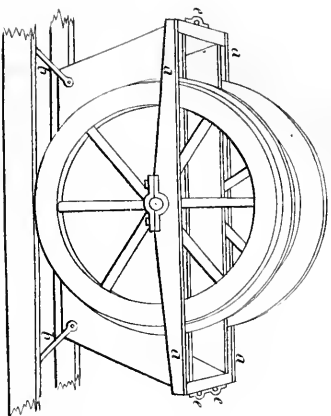


FIG. 2.

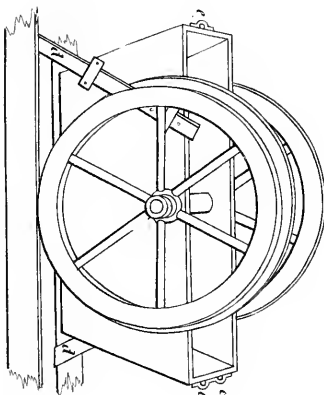


FIG. 7.

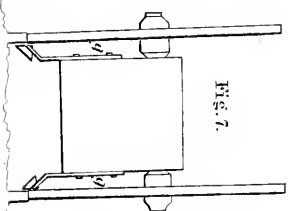


FIG. 8.

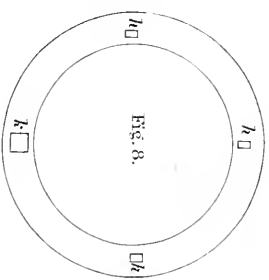


FIG. 5.

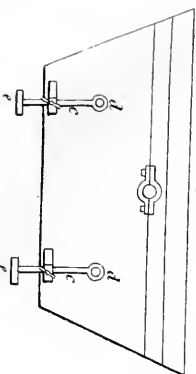


FIG. 4.

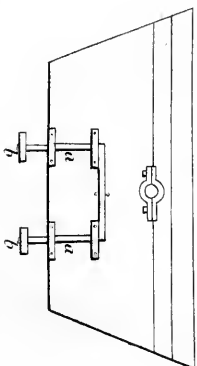


FIG. 11.

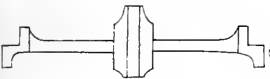


FIG. 10.

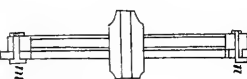


FIG. 9.

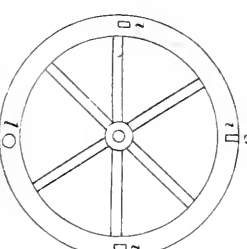


FIG. 6.

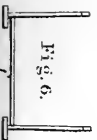
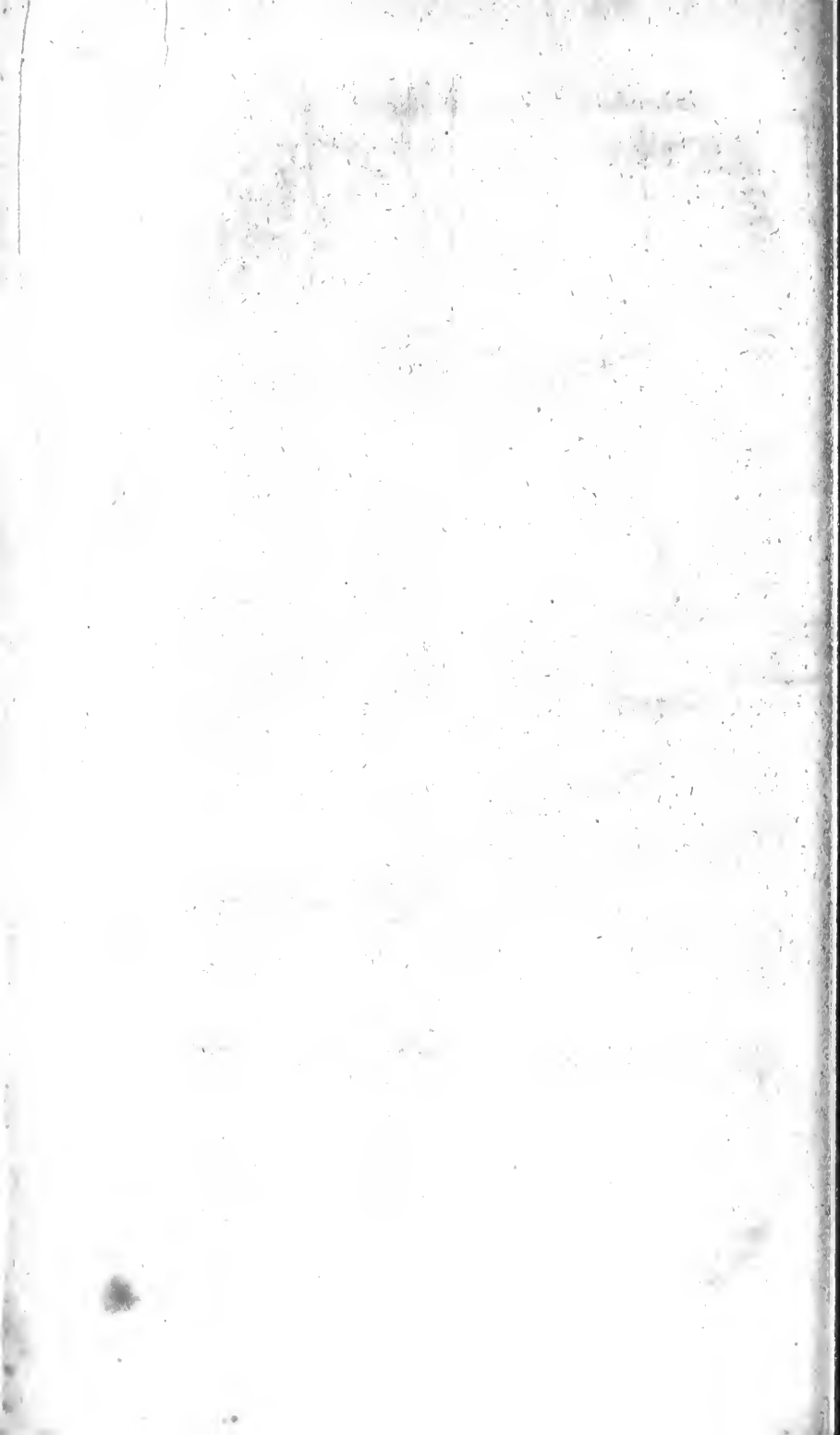


FIG. 3.





ing, they may apply, both ways, a force proportioned to their weight and magnitude; and which, being connected to a lever, or beam, may be applied to driving, or putting in operation, any species of machinery, and thereby saving animal, steam, or other powers, and possessing the very important advantage of contiguity to the marts of the manufactured article.

The invention may be put in use by the affixing of a condemned, or other hulk of a ship of required size. Or floats, with proportionate weights in them, properly affixed in one of our usual slips, or in any tide water, and the beam, or lever, extended into a building projecting over it, or by the side of it, or on the side of streets fronting on the slips, and in other situations contiguous to the tide water; the extent of the power to be regulated by the size and weight of the float.

HENRY M. WESTERN.

Remarks by the Editor.—The power to be obtained upon the foregoing plan, supposing such an arrangement to be made as shall place it all under command, may readily be computed, its elements being the weight which rises and falls, and the distance of this rise and fall, with every tide. It is not, however, to this point that we intend to direct our remarks, but to the question of the form which the specification assumes. A patent cannot be sustained for an abstract principle, and it is incumbent on a patentee to furnish such a practical description as shall enable a person of skill to carry the thing patented into operation. Is this the case in the foregoing specification? We think not; for ourselves, we should feel that the first thing we had to do in carrying it into effect, would be to invent a mode of doing so. The words of the law, are, "And in case of any machine, he shall fully explain the principles, and the several modes in which he has contemplated the application of the principle, or character by which it may be distinguished from other inventions; and he shall accompany the whole with drawings and written references, where the nature of the case admits of drawings." As in this case there are no drawings, no machine is patented; what then is left to be claimed, but the mere principle of obtaining motion from the rise and fall of the tide? This power the patentee claims to apply to machinery, "or any other required use." It has been repeatedly applied to use in raising sunken vessels, and in removing rocks, and other obstructions, from the bottoms of rivers. If, therefore, the claim is intended to be made abstractedly, it seems to us that it cannot be sustained.

LIST OF AMERICAN PATENTS WHICH ISSUED IN DECEMBER, 1829.

With Remarks and Exemplifications, by the Editor.

1. For an improvement in *Propelling Vessels* of every description by means of *INSIDE PROPELLING LEVER WHEELS*, with

the assistance (at pleasure) of the wind-and-steam-assisting-ship-pipes; John James Giraud, Baltimore, Maryland, December 1.

We have read the description, and examined the drawing of the above named apparatus, but have been unable to understand the views of the patentee. Sometimes we have thought that we had caught a leading idea, but on finding that it was essentially visionary or absurd, we have dismissed it, choosing rather to submit to the imputation of dulness, than to suspect the inventor of this machinery of having a confused mind, upon a subject to which he must have given much thought, as he has previously obtained two patents for similar objects. There is a *wheel within a wheel*, and there are steam tubes within air tubes, and we believe that, from these latter, it is intended, sometimes, to blow steam, or air, upon the water in which the boat floats, or upon the sails with which she is to be furnished. When a vessel arrives at Washington, propelled by this machinery, we engage to devote all our powers to its examination, and to give a full report of all our discoveries.

2. For an improvement in Bramah's *Hydrostatic Press*; David H. Mason and Matthew W. Baldwin, Philadelphia, Pennsylvania, December 2.

The patentees say, that "In our improved press the main cylinder, and the plunger, or piston, are constructed as formerly; the principle upon which the instrument acts, also remains unchanged, our improvement consisting in such an arrangement of the forcing pump, or pumps, and its, or their, appendages, as shall give to them greater stability, and render them more compact, and less liable to get out of order, in consequence of the greater simplicity of their parts; thus fitting them the better for general use, and affording them at a reduced cost."

The claim is to "the using of the main cylinder, or the plunger, as a stand, or support, to the forcing pump, or pumps, with their appendages; thereby dispensing with the separate stand ordinarily employed; by which arrangement, one joint suffices for the attachment of the pump, or pumps, without the intervention of a pipe, or tube."

3. For an improvement in the mode of *Distributing Ink*, and applying the same to the types in letter press printing; John Prince, New York, December 3.

Some idea of the construction of this apparatus may be obtained from the account of its operation, and the claim. Two drawings accompany the description, and give a very clear exposition of the whole structure.

"*Operation.* When the carriage of the press is run in and out by means of the rounce, the spring that communicates the power for taking ink, distributing, and carrying the inking roller over the types, is wound up. "When the tympan is raised, a ketch is lifted, that

lets the spring operate in moving the upper roller over the types, and when put down, is again locked."

"Thus, without any other attention from the workman than that of adjusting the screws for regulating the quantity of ink, the whole business of putting the ink on the types is performed, by simply turning the rounce, and running the carriage out and in."

"What I claim as my invention, and wish to secure by patent, is the above described machine, and the peculiar mode of winding up the spring by means of the rounce in running the carriage out and in, by which motion is given to the inking rollers, and conveying them over the types."

In the number for January, (page 38,) we gave a description of an apparatus for the same purpose, invented by Mr. Stone, of the city of Washington. The principle of operation is essentially different in the two machines, excepting in the circumstance of the inking roller being operated upon by the motion of the carriage. We apprehend that from the number of toothed wheels and pinions employed by Mr. Prince, the friction will be increased much more than in the apparatus as arranged by Mr. Stone. In this case, the pressman will be unable to execute the usual quantity of work, and his opposition to its use, from the increase of his labour, will offer a serious obstacle to its introduction. With any apparatus of the kind, the diminution in the work performed must be proportioned to the additional labour from friction; an essential point, therefore, in such a machine, is the lessening of resistance from this cause.

4. For an improvement in *Bolting Flour and Meal*, by means of a "Vibrating Bolt;" William Henry Akins, Berkshire, Tioga county, New York, December 3.

Instead of a revolving frame and cloth, as in the common bolter, a box is used of about five feet in length, ten inches in width, and one inch in depth. This box is covered, at top, with strong cloth, and on the lower side with bolting cloth; it is suspended from the top of the bolting chest by means of four ropes, one at each corner. A shaft extends along the outside of the chest, and two pitmen, one at each end of this shaft, give a vibrating motion to the bolter.

The meal is passed into the bolter, through a bag, open at both ends, passing through the top of the chest, and into the upper end of the bolter.

There is no claim made, either general or particular.

5. For an *Improvement in Distilling*; William Cook, South Port, Tioga county, New York, December 7.

That those acquainted with the various improvements made in the art of distilling, may judge of the *novelty* and value of this improvement, we subjoin the whole specification.

"Let a still be made in the usual manner."

"From the cap of the still, let an arm, or tube, project, which

shall enter into the condensing tub, either at the top, or bottom, nearly; the steam from the still is then conveyed by a tube into the low wines put into the condenser; this steam boils the low wines, and the vapour from the condenser is conveyed by a tube, at or near the top, into the heater, placed at a convenient distance, and is thence conveyed by a worm, through the beer, and also through the cooler, whence the spirits are discharged."

"At the commencement of the operation, strong spirits are produced; afterwards the low wines pass off. These low wines are conveyed to the condensing tub, as before mentioned."

"*Operation.* Charge the still with beer in the usual way; the vapour, or steam, of which passes into the low wines in the condenser, and makes them boil; the vapour from the low wines then passes through the heater, and heats the beer, by means of a tube and worm; they then pass through the cooler by means of another tube and worm, and run off the spirits."

"What I claim as my invention, or discovery, and which I wish to secure by patent, is the condenser containing the low wines, into which the vapour, or steam, from the still enters."

6. For a *Lever Churn*; William Cook, South Port, Tioga county, New York, December 7.

A handle, like a pump handle, is attached to the shaft of the dasher, and works it up and down, the churn of course being placed below. There is no claim, and we think that this was the best mode of treating the subject, as neither *invention*, or *discovery*, appears to be a term properly applicable to this contrivance.

7. For *Rectifying Whiskey, Peach Brandy, Apple, and Cider Brandy*, by distillation, and filtration through sand; Robert Mauck, Addison, Gallia county, Ohio, December 7.

The plan proposed, is, to mix common salt with the spirits to be rectified, to distil the spirit off from the salt, and then to filter the liquid through a layer of washed sand, two feet in depth.

The claim is for doing these two things. We recollect having noticed a patent some months ago, in which it was proposed to use salt in the process of rectification; what are its advantages we are at a loss to tell; with respect to the filtration through clean sand, it certainly can do the spirits no harm.

8. For an improvement in the *Construction, and Mode of Discharging Fire-arms* of various kinds; Robert Eastman, Brunswick, Cumberland county, Maine, December 7.

We intend to give a more particular account of the percussion apparatus invented by Mr. Eastman, as it differs materially from those heretofore proposed, particularly as applied to ordnance.

9. For an improved *Cultivator*; Isaac Cobb, Westminster, Windham county, Vermont, December 7.

This is a wheel plough, with a cultivator, or harrow, placed back of the share, and, consequently, under the handles of the plough. The wheel, we are told, may be removed, when rough ground is cultivated. The description is general, nothing being pointed out as new, and no claim made.

10. For a *Machine for Shearing the Nap from Woollen Cloth*; Merrit Hurd, Augusta, Oneida county, New York, December 7.

There is no specification accompanying this patent, excepting the drawings and written references be admitted as such. No attempt whatever is made to explain the structure and operation of the machine. We are told, merely, that it is "different in principle, as respects the blades, from any heretofore invented;" and so it may be, but how the blades are constructed we know not. Were we to publish all that appears upon the subject, we apprehend that the secret of the patentee would not be thereby divulged.

11. For a *Machine for Manufacturing Wrought or Drawn Nails, Bolts, Rods, Spikes, Hoops and Screws, of every description*; Shadrach Davis, jun. Dartmouth, Bristol county, Massachusetts, December 8.

The machine described consists of collars running upon two shafts, and working into each other like those of an ordinary slitting mill. Two of the collars which work opposite to each other, the patentee calls die plates, they are notched so that one of them may form the nails, whilst the other is supplied with chisels, to separate their heads and points. Some of the collars are so formed as to allow the bars to be rolled square, to prepare them, we suppose, for the die plates. In the description nothing is mentioned but nails, excepting where we are told that "the machine here described is calculated to manufacture nails, and light work of every description; the proportion of the different parts may be varied to suit the work for which the machinery is intended."

The claim is to "the die plates, and the collars projecting from and by the die plates, which give a solid square, or other form, to the metal passing through them; and the chisels on the die plates, for separating the heads and points of nails, &c."

Most of the iron now manufactured into round and square bars, is formed by rollers acting like those described. With respect to the die plates, it will be no easy task so to form them as to make good nails; and, as to screws, all attempts to make these by rollers have hitherto failed, and these attempts have been numerous; there is an intrinsic difficulty in the thing, which will prevent most practical mechanics from essaying it, and will, we apprehend, disappoint the hopes of those who are sufficiently sanguine to make the trial. "Screws of every description" is a very comprehensive phrase.

12. For an "*Improved Shingle Cutter*;" Joel H. Johnson, Pomfret, Chautauque county, New York, December 8.

"The improved shingle cutter consists of a knife with two edges, about eight inches in length, fastened to a plank of about two and a half inches in thickness," &c. "which may be attached to a saw frame, and cuts, from a block, a shingle as it passes up and down; the shingle falls out on the back side."

There is no claim made; the drawing is very indifferently executed, but serves to give a general idea of the machine, and to show that it bears no distant resemblance to some others for which patents have been obtained.

13. For a *Metallic Scraper for Excavating Earth under Water*; Oliver Teal, Salina, Onondaga county, New York, December 8.

This machine is simply a scoop, made of sheet iron, of such dimensions as may accord with the power to be employed. It has a handle in one end, fixed like a spade handle, by which it is to be guided. A bail extends from one side of the scoop to the other, and to this bail a rope is attached, by which the scoop is to be drawn forward, and raised up when full. It is to be worked by man or horse power, and, when filled, lifted out of the water by direct strength. We are not told what is new in it, nor is there any claim.

14. For an improvement in *Percussion Primers for Cannon*; William H. Bell, Lieutenant in the United States Army, Fortress Monroe, Virginia, December 8.

The powder used is the ordinary percussion powder. The primer is made of the thin sheet lead, used in chests of tea; its form, when finished, is that of the segment of a sphere. The claim is to the "making the primers in the form of the segment of a sphere, and in using thin sheet lead to enclose the percussion powder."

It is stated by the patentee, that "these primers have been tested by about 500 discharges of a 24 pounder, with single and double shot, and when used with my percussion lock, produce the utmost certainty of fire in discharging artillery."

Lieut. Bell's lock is not described, nor are we informed what is its particular construction. It may have been the subject of a former patent which we have not seen.

15. For a *Machine for Elevating Heavy Guns*; William H. Bell, Lieutenant in the United States Army, Fortress Monroe, Virginia, December 8.

The gun is to be elevated by a vertical rack, the upper end of which forms a round head, which acts in a socket at the lower side of the pointing board. An endless screw works into a toothed wheel, which turns a pinion, meshing into the rack. The shaft upon which the screw is formed stands across the gun carriage, and is turned

by a crank. The arrangement is ingeniously devised, and appears to us to be well calculated to answer the purpose intended.

The claim is to "the combination of the parts forming the above described machine, with the application of said machine to elevating heavy guns."

A segment of a circle, and an index attached to one of the trunnions, are to be used to point out the actual angle of elevation.

16. For an improvement in the common *Turner's Lathe*, for turning of wood, and other substances; Elijah Putnam, Gardiner, Worcester county, Massachusetts, December 9.

This improvement consists in placing cutters, of suitable shapes, upon a wooden cylinder, placed below the piece of timber to be turned. This cylinder is to be supported between the head blocks of the lathe, and is to be made to turn slowly in a direction the reverse of that of the piece to be turned; motion is given to this cylinder by means of an endless screw working into teeth at one end of it. The cutters are to be so placed, that those to take off the rough shall come first into contact with the rail, &c. to be turned, and, in one revolution of the cylinder, the whole of the cutters are to be successively brought up, and the piece finished.

The cutters, it is stated, may be placed upon a slide, instead of upon a cylinder, but the former is preferred.

An apparatus of this kind, can be applied only where numerous articles of the same form are wanted; and work can never be finished by it with that neatness which the gauge and chisel, used in the ordinary way, produces. In fact, it can do no other than rough work, or the stuff used must be of a texture such as we have not met with in our essays in this art.

17. For an improvement in the *Grist Mill, and in Horizontal Spiral Wheels*; Alexander Temple, Brookfield, Trumble county, Ohio, December 11.

Three stones are to be used in this grist mill, the middle one being the runner; this is in the form of a double cone, the fixed stones being hollowed to receive it. The shaft, or spindle of the runner, is furnished with steel choppers, or breakers, to prepare the grain for entering between the stones. One hopper, with two shoes, supplies the grain which is fed at the apex of each cone, and the meal is delivered at their common base between the two stationary stones; the shaft is to run horizontally.

The improvements which the patentee claims to have made in the horizontal spiral, or tub wheel, consist in some variation in the form of the buckets, and of the issues.

The claim is to the double conical stone; the two breakers working in corresponding hollow cones; the manner of placing the buckets on the water wheel; the manner of moving the damsel by an oval cam, &c.

18. For *Carriages for Rail-roads, and other purposes*; John J. Reekers, Baltimore, Maryland, December 11.

Two pair of wheels, as usual, are to be connected by axles, which are to be cylindrical. Below each of these axles is to be placed a cylindrical rod, or shaft, having pulleys on it; eight are represented in the drawing as placed upon each of these bars; endless chains, ropes, or bands, are to pass round grooves in these pulleys, and over the cylindrical axle of the wheels. The car, with its load, is made to bear upon the lower shaft, and its rollers, with their bands, are intended to lessen the friction.

The particular arrangement cannot be fully explained without drawings, and when we learn that this carriage has gone into successful operation, these shall be furnished. The end attained, as averred by the patentee, is one of great importance, as will be seen by the claim, which is to "the machine, or rail-road carriage, here described, by which the weight of the carriage and load, *act as a pendulum in assisting carriages to ascend inclined planes*. Also the mode of turning carriages on the rail-way, or other roads; and the application of pulleys, wheels, or rollers."

We marvel much in what way a pendulum could be made to assist a carriage in going up hill; the weight, too, "of the carriage and load," also lends its aid, not as heretofore, in descending, but in the reverse direction. Query, will not a double load give double assistance in going up hill? On the second claim, that is on the mode of turning carriages on the rail-way, we find nothing in the specification. With respect to the last part of the improvement, eight pullies, with eight endless ropes, or chains, will, we apprehend, create more friction than they will remove, unless they be formed of materials which furnish ropes without rigidity, and links that have no rubbing parts.

19. For an improvement in the art of *Charring Wood*, for the manufacture of charcoal; Isaac Doolittle, Bennington, Vermont, December 14.

Permanent kilns are to be built of masonry, of such capacity as may be desired. The walls may be run up to the height of 8 or 10 feet, and surrounded at top by a strong band of iron; an arched roof, or dome, is then to be constructed. Vent holes are left at the bottom, and about the middle of the walls, and also in the centre, and other parts of the dome. Chimneys, or flues, are also built around the walls. Door ways are left to charge with wood, and to remove the coal. These may be closed with iron, or with masonry. Stop-pers are adapted to the various vents, so that they may be partially, or perfectly, closed.

The claim is to "the construction of permanent kilns above ground, with arched roofs, chimneys, and vent holes."

It is stated that "by the addition of a simple apparatus, this method of charring wood may afford vast quantities of pyroligneous

acid, which may be applied to various uses in the arts." In situations to which wood can be transported with facility, there can be no doubt of the economy of the plan proposed; and that the quality of the coal will be much better than that burned in the usual way, we have no doubt.

20. For machinery for *Thrashing Grain*; William Barnes, Brookhaven, Suffolk county, New York, December 14.

The resemblance between this and the greater number of thrashing machines is such as to render it difficult to give its distinctive character. A cylinder, with eight, or any other number of iron beaters running along its surface, is made to revolve; the beaters are made of sheet metal, and stand edgewise. The cylinder runs in a hollow segment of a circle, formed of bars of iron, or other suitable material. A feeding apron, and rollers, carry the grain forward between the cylinder and concave segment; the latter is borne up by springs.

The claim is to the springs, and the plates of iron on the cylinder.

21. For an improvement in the machine for *Hulling Cotton Seed*, patented January 21, 1829; Francis Follet, Petersburg, Virginia, December 15.

Mr. Follet has devised an improved mode of feeding the seed to the hulling roller; of adjusting the concave segment; of using a double bottom sieve, and of cleaning the seed as it is hulled, by the addition of a fanner to the hulling machine; it is for these that the present patent is taken.

22. For a machine for *Washing and Boiling all kinds of Wearing Apparel*, bed clothes, or fabrics, viz. woollens, cotton, hemp, and linen of every kind; J. T. W. Dennis, Paintville, Wayne county, Ohio, December 16.

A box, or trough, is formed with the bottom concave, and fluted across. A swing frame is sustained by two uprights, and has a fluted roller at its lower end, the flutes corresponding with those within the trough. The swing frame has its gudgeons within boxes operated upon by spiral springs, to regulate the pressure of the roller. The bottom of the trough is double, there being a space of an inch, more or less, between them. A steam pipe, from a boiler, passes through a hole in the side of the trough, leading into the above named space; the upper, or fluted bottom, is perforated with holes to allow the steam to ascend into the trough. The claim is to "the peculiar mode of constructing this machine as here described, and the mode of using steam between the two bottoms."

23. For a machine for *Setting up Hat Bodies*; Orlando Root, Amsterdam, Montgomery county, New York, December 19.

Machines for setting up hat bodies have become very numerous; they, however, in general, agree in one point, that is, the receiving

the wool from a carding machine, upon conical rollers, on which it is slightly compressed, in order to prepare it for felting. That before us is not an exception to these remarks, its peculiar arrangements cannot be given by verbal description alone; the initiated, however, may, perhaps, form some idea of it from the claim, which is as follows.

“What I claim is the circular motion given to the hat body cylinder, by which the web of wool is wound so as to cover the entire surface of the same; the revolutions of the said cylinder on two conical rollers, with the assistance of four guide pulleys or trundles; the movement given to the carding machine to vibrate the web so as to form the hat bodies; producing the circular motions; the application of the two rail-ways, the carriage, the segments, arms, cams, and irons that support the rail-way; the conical rollers, the counter revolving shaft, and the sliding shaft, with their cog wheels upon them; the dog and spring, the perpendicular lever, with its fork and weight upon it; the block of wood on which the lever is suspended, the axletrees and trundles, the position of the same as described in the arrangement; producing the rotary motion of the cylinder; the application of the conical drums to regulate the motion of the cylinder; the manner of extending the power from the driving shaft, to the centre, of which the rail-ways are the segments, and from the centre of the vertical shaft, which is suspended under the centre of the carriage; and also from the top of this vertical shaft to the inclined shaft, and from the inclined shaft to the small end of one of the conical rollers; with the positions of these two conical rollers, and the guide pulleys, or trundles; also the application of the rail-ways, shaft, chains and gears, herein described, to vibrate the carding machine, together with their parts, bearing, positions, and principles appertaining to the same.”

We would not invite patentees to adopt, as a model, the foregoing mode of stating their claims; the enumeration made, descends too much into such minutia as must render it very difficult, if not impossible, to sustain the claim. There must, in every patentable machine, be some distinctive characteristic which separates it from all others, and without which it cannot exist; it is this characteristic upon which every legitimate claim must be founded. Such terms as “parts, bearing, positions, and principles appertaining to the same,” should they not be considered, in a court of law, as mere surplusage, would, we think, vitiate any patent.

24. For *Weaving Narrow Stuff, such as Ribands*, web-bings, tapes, ferrits, girthings, chain lace, fringes, &c. without the use of shuttles; John Thorp, Providence, Rhode Island, December 22.

The spools, or bobbins, upon which the filling is wound, are placed in some fixed situation above the loom; there are two of these bobbins, one supplying the filling on the right, and the other on the left side of the warp. Each thread descends through a loop in a flexible

wire spring, which serves to preserve its tension; two arms, or levers, one on each side, carry the thread into the web. When the thread is carried in, it is caught upon a pin on the opposite side, the arm then returns, leaving the thread looped upon the pin, and consequently doubled; the web is then trod, or sprung, and the filling beat up to its place. The web is next supplied with woof from the opposite side, and from the other spool, in the same manner as it was from the former, which binds the web together and forms a selvage on both sides of it.

The arms, or levers, are worked by racks and pinions, placed below the breast beam, the racks being acted upon by a crank motion. The arms which supply the filling, are, in general, made to answer the purpose of the reed and lay, in beating up.

25. For a *Labour Saving Churn*; Samuel J. O'Brien, New York, December 22.

The inventor tells us that "this new and valuable invention consists in the application of a self-moving power, to the common dairy churn, thereby dispensing with the labour required in churning butter by the common mode."

A weight suspended by a pulley and cord is to be wound up like that of clock, or a roasting jack. The drum, or barrel, upon which the cord is wound, has a cog wheel on one end, which gears into a pinion, upon the shaft of which there is a fly wheel; a crank from this shaft works a pitman connected with the shaft of the dasher of the churn. To preserve the vertical motion of the dasher, there is a slide of iron, to serve as a guide, and fixed "in the same manner as the piston of a steam engine." There is no claim.

26. For an improvement in *Wernwag's Patented Bridges*; Lewis Wernwag, Jefferson county, Virginia, December 22.

The improvements for which the present patent is taken, are, "the mode by which the floor, sides, and top of the bridge are braced and held together by diagonal, horizontal iron braces, to prevent its being crooked, also for straightening it when it becomes deranged. The manner of placing the timbers, forming the arches, loosely, between two, three, or more king posts, so that any of the timbers may be taken out, and others put in, without disturbing, or injuring, the other parts of the bridge."

"The mode of supporting bridges on piles, by metallic or stone segments, to prevent their rotting between wind and water, which may be roofed." The above improvements are also claimed as applied to revolving bridges over canals, &c.

27. For a *Tide Power*; Henry M. Western, New York, December 23.

(See specification.)

28. For an improvement in the *Grist Mill*; Mark L. Chase, Frankfort, Waldo county, Maine, December 23.

Instead of stones, cast iron grinders are to be used; these are to be cast with the teeth, or dressing on them, both grinders being alike in this particular. The teeth of the grinders are inclined, like those of a saw. They form curves from the centre to within 3 or 4 inches of the periphery, where their form is altered from curved to straight, and their direction changed, so as to retain the substance to be ground until perfectly pulverized; the curves are in the direction of the revolution. The lower grinder is to revolve, the upper to be stationary.

We are told that "the advantages of this improvement, are, a saving of two-thirds of the expence of construction, and of the moving power; and by causing the lower grinder to revolve instead of the upper one, fine meal may be made with less friction than is encountered in the common mill."

There is no particular claim, and it would seem by the above, that the patentee supposes the running of the lower stone, or grinder, to be a novelty; those, however, who have attentively read this Journal, know that it has been repeatedly done.

29. For an improvement on the machine invented by Francis Follet, for *Hulling Cotton Seed*; Jabez Smith, Petersburg, Virginia, December 28.

We have spoken of Mr. Follet's improvement in the feed part of his machine. Mr. Smith, who is associated with Mr. Follet in the proprietorship of this apparatus, has also devised a mode of regulating the feed from the hopper to the cylinder, to secure which is the object of the present patent; should we hereafter determine to describe the whole machine, these various improvements shall be properly represented.

30. For a machine for *Paring Apples*; Reuben Mosher and Amos Mosher, Galway, Saratoga county, New York, December 28.

At least two patents have been previously obtained for the same purpose as that above named. The first was issued to Moses Coates, of Pennsylvania, in February, 1803. In that machine the apple was placed upon a forked spindle, which was turned by a crank, and a knife, with a guard, something like a spoke-shave, was passed over it, its pressure being regulated by a spring.

The machine of the Messrs. Mosher bears a great resemblance to Coates'; the spindle and fork are the same, but a multiplying wheel and band are used, to accelerate the motion. The knife is the same in principle as in the original machine. A minute description of lengths, widths, and thicknesses, is given, extending over seven pages, but no claim is made to any part.

We have not thought it necessary to examine the other patent

granted to S. Curttenden, of Connecticut, which, by the list, we find bears date, August 25, 1809.

31. For an improvement in the *Mode of Burning Bricks*; Nathaniel Adams of Cornwall, and Aaron Noyes of Newburg, Orange county, New York, December 28.

We are directed in the specification to "take about one ounce of finely pulverized coal, and mix it with clay sufficient for making a brick weighing about 4 pounds when burnt."

"The bricks are also moulded in fine coal; they are then sun dried, and set in the kiln in the usual way."

"In burning the kiln, care must be taken that the arches are evenly heated, and fire made sufficiently strong to harden the bricks while the coal is burning out of them."

"*Invention claimed.*—We claim the mode of mixing and moulding in coal here described; also the method of burning."

By the mode of mixing, we must understand simply the mixing, as no particular manner of doing this is pointed out; nor do we see any thing described in the *mode* of burning, but that the heat should be even; and this certainly is not a new discovery.

By turning to page 420, vol. 3, new series, it will be seen that a patent was obtained by James Wood, of New York, for mixing finely pulverized coal, with clay, for making bricks, tile, or other clay ware. We apprehend that the two patents are, essentially, for the same thing.

32. For an improvement in the *Application of Hot Water, or Steam, in the making of Casks, Barrels, Hogsheads, or Kegs*; Jonah Thompson, Philadelphia, Pennsylvania, December 30.

The claim of the patentee will fully exhibit the nature of his improvement, it is in the following words.

"All that I claim as my improvement, and for which a patent is asked, is the application of steam, or boiling water, to the staves of casks, barrels, hogsheads, or kegs, so that they may be set up and formed. The use of steam in seasoning wood, and rendering it flexible, having been long known, but never having been before applied to the manufacture of kegs, barrels, casks, or hogsheads."

33. For an improvement in the *Spinning and Roping of Wool and Cotton*, by means of a machine called the "Golden Spinner;" Joseph B. Wheeler, Galway, Saratoga county, New York, December 30.

This is another modification, or alteration of form, of the Domestic spinner. It is intended to carry from 6 to 18 spindles; 12, it is said, may be worked by hand. A machine somewhat similar was patented by Mr. Wheeler, under the name of the "Complete Spinner," upon which this purports to be an improvement. The spindles

stand horizontally on the upper part of a frame about 5 feet in height. A crank is to be turned by hand, which gives motion to the necessary wheels and whirls, by means of bands. The claim is to the mode, described in the specification, of hanging and adjusting the spindles; and to the manner of gearing, and giving motion to the whole.

34. For an improved *Thrashing Machine*; John Haws, Hudson, Columbia county, New York, December 31.

Cylinders, beaters, grooved or toothed pieces borne up to the cylinders by springs, feeding rollers, and feeding aprons, form the essential parts of this machine. To us it appears to differ in form only, from several others. The part which, in many thrashing machines, is called a hollow segment, and between which and a revolving cylinder the grain is thrashed, is here made narrower than usual, and is called a grate piece. The claim is to "*the grate piece on springs, and the cylinders and grate piece covered with cast iron plates, cast with teeth.*" In a second cylinder, constructed somewhat differently, "*the grate piece on springs; the moveable frame on hinges; and the beaters running diagonally across the cylinder,*" are claimed.

35. For a *Power Machine, to Drive, or assist in driving, other machinery*; William Hosford, Washington Township, Marion county, Ohio, December 31.

It would be a mere waste of time and paper to offer any description of the machine for which the patent under the above title was obtained. The specification and drawing, however, harmonize with the invention, the three affording but sorry specimens of the progress of science, literature, and the arts.

There is to be some sort of a vibrating, jointed frame; to which is to be attached a pitman, working, or worked, by a crank and a fly wheel; within the frame are to be placed two rollers, which, as they roll backwards and forwards, are to strike against springs, and to become so invigorated by their action, as to drive the machine to which they are attached, and any others which may be placed within their sphere.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On the mode of laying the Rails, and the adaptation of the Carriages on the Baltimore and Ohio Rail-road. By THOMAS EARLE, Philadelphia.

THE usual mode of keeping the carriages upon rail-roads, is by means of ledges, or flanches, projecting from the *inner* edges of the rims of the wheels, which flanches must, of course, run against, or within, the inner sides of the rails. Consequently, where the rails are composed of wood and iron combined, the iron is nailed upon

the wooden rail next its inner edge, so that the edge of the iron protects the wood from the action of the flanches.

Upon the Baltimore and Ohio rail-road, a different construction is adopted. The iron is nailed upon the wooden rails next their *outer* sides, or edges, and, consequently, the only wagons which can be used, are those which have flanches projecting from the *outer* edges of the rims of the wheels, and running without the outer sides of the rails.

There are three disadvantages which appear to me to attend this method.

1. The load, in wagons of the usual form, always tends to strain the axles and bend their outer ends *upwards*, the wheel having, to a certain degree, the power of a lever. If the flanch be *without* the rail, whenever it presses against its side, a more powerful leverage is obtained, pressing the bottom of the wheel outward, and, of course, the end of the axle upward, or in the same direction as does the weight of the load. Thus a double force combines to strain the axle. But if the flanch is on the inner edge of the wheel, and runs within the rail, whenever it presses against the side of the rail, it tends to press the bottom of the wheel inwards, and, consequently, the end of the axle downwards, acting against, and neutralizing, the contrary pressure from the load. Hence the axles may safely be made smaller in the latter case, and have less weight and friction than in the former.

This objection, however, will not apply, if Mr. Winans' carriage alone be used, as in them the bearings upon the axles are outside of the wheels.

2. The tendency of the wheels to run off of the rails, which operates to prevent their being made of as large circumference as would be desirable, is greatly increased by the Baltimore method. For whenever there is a curve in the road, the weight of the load, from its previous impetus will be thrown upon the outer wheels, while the inner wheels, or those upon the inside rail of the curve, will tend to rise off of the rail. When the flanches are on the inside of the wheels, it will be the flanches of the outer wheels that will protect the carriage from running off, being the same wheels which are pressed firmly down by the load: but with the Baltimore carriages, the flanches of the *inner* wheels on the curve, will be the only guard against the wagon keeping straight forward, and running off the rails. The tendency of these inner wheels to be lifted up, so that they can pass over the rail, will greatly increase the danger.

3. If by any obstruction, or accident, the carriage should be thrown sideways, and the flanch of one wheel thereby lifted upon the rail, the larger circumference of the flanch would make that wheel travel faster than its opposite. This, if the flanch were on the outside of the wheel, would increase the wrong direction already given, and inevitably carry the wheels off the rails. But if the flanches were on the inner sides, the faster travelling of the raised wheel would restore the proper direction, and carry the wheel back to its

place. Hence we may see why few, or no instances, of the wagons, upon the common construction, running off the road take place.

Any person may try two model wagons, and he will find that one having the flanches on the outer sides of the wheels, will run off the road, if the wheels of either side be raised upon the rail; but if the flanches are on the inner side, though those of one side be raised upon the rail, they will return to their proper place.

For these reasons I would respectfully suggest to the directors of the important public work referred to, the propriety of re-considering their plan, and altering it if they shall see occasion.

Query on the Thermometer.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

I SHOULD be obliged, if some of your readers would make known, through this medium, the method by which we can ascertain the true increase or diminution of caloric, in a given quantity of matter, by the thermometer.

If, for example, a quart of water exhibit 40° Fahrenheit—apply heat until the temperature be 80° . It is then usual to consider that the water contains a double portion of caloric. But if we take Reaumur's scale, the quantity of water, at 40° Fahrenheit, would be $3^{\circ} 55$ Reaumur, to which apply heat, until it be raised to double $3^{\circ} 55$, or $7^{\circ} 10$, and the water would be only equal to 48° Fahrenheit.

Suppose Fahrenheit, instead of fixing his zero at the temperature produced by ice and salt, had placed it at the freezing point of nitric acid, say 52° below his present zero, which degree of cold was experienced by Parry, at Melville Island. Then the water, by the existing scale at 40° , would have been $40 + 52 = 92^{\circ}$, and when at 80° , would have been at $80 + 52 = 132^{\circ}$, showing a deficiency of 52° towards a double quantum of caloric.

It appears to me, that unless a thermometer scale be graduated from a natural zero (a state containing no caloric) it must even fail to indicate, not only the *absolute*, but the true *relative* degree of heat; supposing it to be sensible to the thermometer *pro rata* with its intensity.

T. W. B.

Cincinnati, February 4, 1830.

Method of Preserving Butter.

TRANSLATED BY A CORRESPONDENT, FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

COMMON salt is the only substance hitherto employed for the preservation of butter. I have made many experiments on this subject, and the following method appears to me preferable to the old one, as it preserves to the butter a more agreeable flavour, and a better colour, and renders it less liable to become rancid.

Take one part of loaf sugar, one part of saltpetre, and two parts of pure salt; mix and reduce them to a very fine powder. As soon

as butter is perfectly worked (to extract the buttermilk) work into it one ounce of the above mixture to each pound, and pack it immediately, and as closely as possible, into pots, and smooth the tops over carefully; then cover the pots over with a fine linen cloth, and tie a piece of wet parchment (or bladder) over the whole. After a few days it will be found that the butter has settled, and no longer fills the pots completely, they must then be filled up, taking care that no space be left; then pour over the top a small quantity of butter melted at a low temperature, sprinkle over the surface a small quantity of the above mixture, and stop the pots as tight as possible, to exclude the atmospheric air. They should not be again opened until the butter is wanted for use. In this manner butter may be preserved several years; I have had it at the end of two years as fine flavoured as in the first month.

It should be remarked, that butter prepared in this manner, is not fit for use in less than a fortnight after being packed. By that time it will have acquired a very agreeable flavour, and so fresh, that persons who are in the habit of eating salted butter,* can hardly believe that this has ever been salted at all.

On opening the pots, care should be taken to use the top first, and not to cut down by the side. And if all the butter contained in one pot is not to be used immediately, what remains should be covered with the same care as at first; or it may be kept covered with brine.

Butter may also be preserved by working into it a small portion of pure honey, which imparts to it a very agreeable flavour, and renders it very valuable for aged persons, and those who have weak stomachs. I have seen butter preserved in this manner, which had been kept for several years, and which showed no tendency to become rancid. One ounce of honey to the pound.

[*Journal des Connaissances Usuelles et Pratiques.*]

FRANKLIN INSTITUTE.

Monthly Meeting.

The stated monthly meeting of the Institute was held at their Hall, on Thursday evening, January 27, 1830.

Mr. SAMUEL V. MERRICK, was appointed chairman, and WILLIAM HAMILTON, Recording Secretary, *pro tem*.

The minutes of the last meeting were read and approved.

The following donations were presented, viz.

Strickland's Reports on Canals, Rail-ways, Roads, &c. presented by Major N. Ware.

Jones' Views of the Metropolitan Improvements, or London in the 19th Century, from original drawings, No. 1 to 37, inclusive, presented by Mr. David M. Hogan.

* In France, and especially in Paris, butter sold in the markets, is, for the most part, entirely destitute of salt; and is so served at table, where each one salts to suit his own taste.--TRANSLATOR.

The Canal Engineer's and Contractor's Assistant, by Charles Potts, presented by the Author.

Euvres de Roi de Prusse, 10 vols. presented by John Bouvier, Esq.

The corresponding secretary laid on the table the following works received in exchange for the Journal of the Institute.

London Journal of Arts and Sciences, for December, 1829.

London Journal of Arts and Register of Patent Inventions, for October, November, and December.

Gill's Technological and Microscopic Repository, for December.

Journal Universel des Sciences Médicales, for September.

Bibliothèque Physico-economique, for October.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, for September.

Annales de Chimie et de Physique, for August and September.

Annales des Mines, vol. 5, Nos. 2 and 3, for 1829.

The committee on subjects for discussion, submitted the following question, "What is the difference between the absolute efforts employed to move a locomotive engine, when the force proceeds in one case from the engine itself, and in the other from a stationary engine, supposing the plane over which the motion takes place, to be horizontal?" which was accepted, and selected as the subject for discussion at the next meeting.

Professor Johnson presented for examination several very fine specimens of porcelain, manufactured in this city, by Messrs. Smith, Fife & Co.

Extract from minutes.

SAMUEL V. MERRICK, *Chairman*.

WILLIAM HAMILTON, *Recording Secretary, pro tem*.

Board of Managers.

A meeting of the Board of Managers was held at the Hall of the Institute, January 25, 1830.

JAMES RONALDSON, President, in the chair.

The Actuary read so much of the minutes of the annual meeting of the Institute as related to the election of this Board, whereupon the Board went into an election for the officers of the Board for the ensuing year; Messrs. Samuel J. Robbins and Isaac B. Garrigues were appointed tellers, who reported the following gentlemen duly elected, viz.

SAMUEL V. MERRICK, *Chairman*.

MORDECAI D. LEWIS, } *Curators*.

CHRISTIAN GOBRECHT, }

The president having left the chair, it was taken by the chairman, when, on motion, the by-laws, adopted by the former Board, were read, and after some amendment, adopted by this Board.

The candidates proposed at the last meeting of the former Board, were duly elected members of the Institute.

Several candidates for membership were proposed, and laid over till the next meeting, in conformity to the regulations.

A stated meeting of the Board of Managers was held at the Hall of the Institute, February 11, 1830.

SAMUEL V. MERRICK, *Chairman.*

The minutes of the last meetings were read and approved.

The chairman nominated the standing committees, in conformity to the regulations, which, after adding Messrs. James J. Rush and W. R. Johnson to the committee on inventions, and Mr. S. V. Merrick to the committee on publications, and the managers of the sinking fund, was approved by the Board as follows.

On Premiums and Exhibitions.

James Ronaldson,	Isaiah Lukens,
Samuel J. Robbins,	Frederick Fraley,
Matthias W. Baldwin,	Thomas U. Walter,
Benjamin Reeves,	James M. Bolton.

On Inventions.

James Ronaldson,	Benjamin Reeves,
Matthias W. Baldwin,	Rufus Tyler,
Christian Gobrecht,	James J. Rush,
Isaiah Lukens,	Walter R. Johnson.
Andrew Young,	

On Publications.

Samuel V. Merrick,	Isaiah Lukens,
Isaac Hays, M. D.	Matthias W. Baldwin.
Rufus Tyler,	

On Instruction.

George Fox,	Adam Ramage,
Isaac B. Garrigues,	Charles H. White.
Henry Horn,	

On the Cabinet of Models.

John Struthers,	Thomas Scattergood,
John O'Neill,	Thomas Loud.
Joseph H. Schreiner,	

On the Cabinet of Minerals.

Thomas M'Euen, M. D.	Thomas Fletcher,
Isaiah Lukens,	James Rowland, jr.
Abraham Miller,	

On the Library.

Isaac Hays, M. D.	Thomas U. Walter,
Samuel J. Robbins,	Charles H. Kerk.
Mordecai D. Lewis,	

Managers of the Sinking Fund.

Samuel J. Robbins,	Matthias W. Baldwin,
Frederick Fraley,	Samuel V. Merrick.

Auditors.

Abraham Miller,	Isaac B. Garrigues.
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On motion, it was resolved, that the same gentlemen who were appointed by the former board on the special committees, for trying the experiments on water wheels, and for reporting the form and design of a diploma of membership, be again charged with those duties.

Extracts from the minutes.

S. V. MERRICK, *Chairman.*

WILLIAM HAMILTON, *Actuary.*

ENGLISH PATENTS.

To JAMES FRASER, *Engineer, for a new and improved method of Distilling and Rectifying Spirits and Strong Waters.* Dated March 4, 1826.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said James Fraser, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, is particularly described in manner following, (that is to say:)—That my invention consists in an arrangement of parts, by which the process of distillation is completed, by the vapour or steam of the first or primary still being made to pass through the interior of the spirit or secondary still, by means of tubes or hollows of any shape or form, or such as are commonly used for heating by steam, or for the purposes of condensation, but an extensive surface ought to be kept in view; or by the said steam of the primary still being made to act on the external surface of the said spirit or secondary still; or by the said steam or vapour of the said primary still being made to act on the external part, and on the internal part also of the said spirit or secondary still at the same instant of time; thus placing the contents of the secondary or spirit still between the entire power of the steam or vapour from the primary still in its passage or passages, into the primary worm or condenser, and such secondary still can be placed on the top of the primary worm or condenser, or in such situation as convenience may point out, so that the steam of the primary still is made to act with effect as above. The above is the patent for which I declare, connected with the above system, for which I claim exclusive right, and which will materially lessen the empyreuma always attached to new made spirits.

I proceed to describe a simple and efficient process, partly original, and partly the effect of the practice of others, for which I do not claim exclusive right, but which is necessary to be known to form a more complete and perfect whole. In the first place, surround the primary still with water; when this boils it will also boil the contents of the primary still, and also prevent the sediment of the wash or low wine from adhering to the bottom: this has been my practice for a considerable time. It is here evident that the water round the primary still can be heated much above what is required to boil the primary still, and that the steam of this water can also

be made to heat the wash prior to its entrance into the interior of the primary still, or to boil any other fluids at a distance from the fire, or steam casks, &c. &c. The water boiler and the primary still being now charged, and both in a state of ebullition, the vapour proceeds through the head and connecting tube, into the secondary still, from thence to the worm or condenser; and as it is of great importance to prevent the wash or low wine from boiling over into the worm or condenser, a check is placed in the secondary still to prevent it: by a check is meant any opposition at a higher level, so that if room is left between the contents of the still and the said check, whatever boils up will not be able to get over, but remain between both until the fire is damped, and the whole returned to the still as at first; this check is perhaps three parts up, leaving one for the vapour to get over, which has also the property of separating the aqueous parts from the spirit, as the lighter body rises to the top and passes over the said check. The primary still being now run off, is again filled with heated wash; the contents of the first charge is supposed to be received below the primary worm or condenser into a properly secured recipient; from this recipient it is pumped up into the secondary still, the wash being highly heated before it passes into the primary still, speedily boils, and its vapour being in contact with the surface which contains the spirit thus pumped up, the finish or rectification in the secondary still will proceed rapidly, and pass into its own worm or condenser, and so on into its own recipient, as a finished article. It is not difficult to imagine two primary stills kept in action by one secondary still, nor a secondary still by the surrounding water of the primary still; nor a rectifying still being made of the primary still by this system; in fact, this system can assume any form, and will not only place our distilleries on the most economical and efficient footing, but save at least fifteen per cent., and yield a very superior article, whilst it secures the duty to the certainty of a fraction.

In witness whereof, &c.

Obs.—On a superficial perusal of this specification, it will appear to include in the patent right much more than is really intended; but a more careful examination will show that no claim is made in it to the modes of distillation, the description of which occupies the greatest part of its contents, and by far the most valuable. It is not easy to imagine what could induce the patentee to encumber this document, with so much matter irrelevant to its main object, (of describing the improvements to which his patent extends,) and it appears to us that his doing so is far from being judicious.

The causing the vapour from one still to act on the contents of a second still, for the evaporation of their spirituous portions, (which includes all that is really claimed by the patentee) has often before been practised in various ways, being in fact nothing more than distillation by a steam bath: and as to the internal application of this bath, by tubes passing through the second still, which may seem a new application of the principle, that also has been practised by

Mr. Smithson Tenant, previous to the year 1815; his method of doing which, and a description of his apparatus and of its advantages, may be seen in our 27th vol, second series, p. 214. Mr. Tenant employed, in addition, an artificial vacuum; but this does not alter the case, as the present patent process is evidently that of this experienced chemist, denuded of this circumstance.

Another mode of employing the vapour of one still to cause distillation from other stills, invented by Mr. Adam, is given in our 20th vol. second series, p. 180 and 238; and that of M. Berard, for the same purpose, in p. 370 of the same volume. [*Rep. Pat. In.*]

To JAMES WRIGHT, Soap Maker, for improvements in Condensing the Gas or Gases produced by the decomposition of Muriate of Soda, and certain other substances, which improvements may also be applied to other purposes. Dated April 28, 1829.

THE specification of this patent has not been enrolled, but the following account of the invention has been communicated to us by the patentee.

A circular wall is built of a size deemed sufficiently large for the extent of the manufactory; and covered with a roof or dome, with one outlet in the centre; the bottom of the circular chamber thus formed is lined with lead or other substance impervious to water, and around it are placed as many decomposing furnaces and driers, as can conveniently be managed, with a flue proceeding from each, terminating in the inside of the chamber, so that the gases from each meet, as in a common receptacle. By means of a force pump, water impregnated with lime is constantly injected into the chamber, through a perforated hose; this attracts a great portion of the gas, and settling in the bottom of the chamber, forms a stratum of lime water, which quickly absorbs the portions of gas which follow, and also cools and moistens that portion of the gas which is not condensed, rendering it more fit for the second operation. This gas makes its escape from the chamber, by a horizontal flue from the centre, which may be continued to any length, terminating in a circular cast-iron pipe of the same size as the flue, which passes into a wooden cylinder lined with thin lead; a similar pipe connects the flue with another cylinder, or with the chimney, and may be placed at any distance from the former that may be deemed most expedient. These cylinders revolve upon the flue pipes as upon an axis, and have a number of shelves placed in the interior, parallel to their axes; between each shelf is an opening with a cover to fit, by which is introduced a quantity of slacked lime. The cylinders are made to revolve by the same power which works the force pump, which causes the shelves to disperse the lime in every part of the cylinders, thus keeping an atmosphere constantly loaded with lime in a state of most minute division, through which the atoms of gas must pass, and they are thereby so completely absorbed, that (vegetable blue)

test paper, placed over the top of the chimney, remains unchanged. The patentee approves of two cylinders being used on the same flue, as they render the success of the operation more certain, and allow an opportunity of changing the lime in one, while the other continues at work.

Mr. Wright likewise asserts, that his invention is applicable to the purification of coal gas, and to the manufacture of chlorate of lime. He states that the gases coming from the retorts being passed through the chamber and cylinders where lime is in so complete a state of division, and presenting a constant succession of surfaces, the whole of the sulphuretted hydrogen is absorbed, leaving the carburetted hydrogen in a state of great purity. In manufacturing the chlorate of lime, he decomposes the muriate of soda in one set of retorts, and drives off in another set, by means of heat alone, the oxygen from the black oxide of manganese; the pipes from each terminate in a horizontal main or general receiving pipe, on both sides of which are placed any number of revolving cylinders, charged with fine lime, which, by this method, becomes completely saturated. The residuum of his retorts, is, in one set, sulphate of soda, without any admixture of sulphate of manganese; and in the other, manganese, deprived of a part of its oxygen; which manganese, upon being exposed in thin strata to a circulation of atmospheric air, speedily recovers the oxygen it had lost, and becomes fit for future operations. A great saving, the patentee affirms, is thus effected, and the chlorate of lime produced will be of a much superior quality.

[*Id.*

To WILLIAM FARISH, Jacksonian Professor in the University of Cambridge, for an improved method or methods of Clearing out Water-courses. Dated September 4, 1828.

THREE methods are described in the specification of this patent, for effecting the purpose stated in the title. In the first, a vessel is used of an oblong form, rectangular for the greatest part of its length, but sloped in an angle of about 45 degrees from the bottom upwards in front: this vessel is suspended on two pivots, resting on adequate supports, at about a third of its length from the hinder end; which latter is made so as to be heavier than the front portion, and is sustained in a horizontal position by a prop underneath, or other sufficient means; and water being let to run into this vessel from a higher vessel, as soon as it becomes full, the larger contents of its front part will cause this to overbalance its hinder portion; when it will turn over, and discharge the whole into the water-course beneath, and will again fall back by the greater weight of its hinder part, into a horizontal position ready for another charge.

In the second method a vessel is used for the same purpose, and constructed on the same principle as the first, but of a different form. The outline of the longitudinal section of this vessel somewhat resembles a small portion of a volute, proceeding from a circle,

having the projection of the former turned upwards; the water runs in at the lip formed by this projection, and the vessel being suspended on pivots, similarly to the former, but placed at the centres of the cylinder, (of which the circle mentioned is the section) when it becomes full to near the edge of the lip, its front part will turn down, from the greater weight of water in the projection, and will discharge the whole of the contents into the water-course underneath: a counterweight at the side opposite to the lip will bring back this vessel to its first position when empty, as in the former instance; adequate stops being provided to prevent it, as well as the other vessels, from turning round too far in either direction.

In the third method a turning vessel is used, nearly of the same shape as the last, and supported in the same manner, but closed at the lip so as to leave but a small aperture; this vessel is enclosed by a water tight case, adjoining to the bottom of a reservoir, that is placed at a higher level than the water-course, and is supplied by a stream of water; from the top of this case a tube ascends vertically to within an inch or two of the highest level, to which the water in the reservoir is capable of rising; and a funnel is fixed in the top of the turning vessel directly beneath this tube; when the water ascends above the top of this latter, it will of course fill the vessel, and cause it to turn round with the projection downwards similarly to the others; in which position it will remain, until the whole of the water that it has received be discharged by the small aperture mentioned. The turning vessel in this case is only employed as a means of drawing a horizontal valve from over the orifice of a large tube, by which the whole of the water in the reservoir then runs down into the water-course; this is effected by a vertical toothed wheel on the pivot of the turning vessel, that operates on a horizontal toothed rack, a bar from which runs out to the valve, through a stuffing box in the enclosing case; and another tube of smaller dimensions, that proceeds downwards from the bottom of this case to the water-course, and carries off all the water that runs into it from the turning vessel, completes the apparatus. The use of the small dimensions of the aperture in the projecting part of the turning vessel, is to prolong the time of the discharge from the reservoir; since, when the vessel is entirely empty, its counterweight, in restoring it to its first position, will at the same time close the valve of the tube, through which the discharge is effected.

Obs.—Since it is evident, that an adequate effect from a discharge of water in clearing a water-course cannot be produced by a very small quantity, it appears to us that the two first methods for this purpose directed in this specification, cannot be of much utility; no vessels of any manageable size being capable of holding the water, that would be required to occasion any perceptible operation on the mud in the bottom of trenches or canals of this nature. The third method would not be liable to this objection; but as the quantity of the discharge of water, that it could effect, must depend on the time that the turning vessel required for evacuating its contents, unless

the size of this vessel were enormous, the discharge could not even in this case be very great.

We, however, think that it would not be difficult to keep the valve of this apparatus open, until the *whole* of the contents of the reservoir were discharged; by the addition of a small vessel to be filled by the discharge, the weight of which should raise a bolt, to keep the valve from closing as long as it remained full; but which being emptied on the discharge ceasing, by means of a small hole at its bottom, would no longer counterbalance the weight of the bolt; by the consequent descent of this, the valve being freed from impediment, would again close, and cause the reservoir to be filled for a new operation.

Still, however, even if this objection were removed by the means proposed, or some other equally efficacious, since a fall would be required at the end of the water-course, to let the water run from it, according to the method of the patentee, and another fall still greater into it at its head, for the operation of the apparatus, together with a stream of water descending into this latter fall, it appears to us that this stream, aided by the two falls, would keep the water-course clear, in any case, where water sufficient was supplied by it to work such an apparatus, without the assistance of the latter, or that of any other machinery.

It also appears to us, that as the chief deposits of mud, or other sediment, and those most necessary to be cleared away, are made in channels, or other places, to which the tide has access, (which renders it necessary that any discharge from reservoirs, for the purpose of clearing them, should be made at the time of low water,) the apparatus of the patentee not being applicable to such situations, (from its discharge depending on an upper fall of water, and, consequently, being in no wise affected by the tide,) would be of very little general utility. We can readily conceive how the retreat of the tide might be made to open reservoirs of the nature of those mentioned, but even this would not be sufficient, since there are places, where the reservoirs or basins must not be discharged every tide; as, for example, the artificial harbour of Dunkirk, where the discharge is only made about once a week; but then in such abundance, as to visibly agitate the sea two miles from the shore; this latter circumstance more particularly demands notice, from the great deficiency of most plans, hitherto used for similar purposes, arising from the basins, serving as reservoirs, being too small to afford any adequate discharge.

A very good method of managing the clearing of canals in similar situations, applicable also to harbours, and tide mill ponds, may be found near the end of Mr. Bramah's very singular specification of the patent granted to him for improvements in the conveyance of water, &c. which is inserted in our 23d vol. p. 257, second series.

[*Ib.*

To JOHN DICKINSON, Paper Manufacturer, for a new improvement in the method of Manufacturing Paper by Machinery, and also a new method of cutting paper and other material into single sheets or pieces, by means of machinery. Dated January 14, 1829.

THE patentee commences by stating, that after the first consolidation of the pulp into paper, by means of the greater part of the water being drained off, by passing over a continuous web of woven wire, it is, in the usual course of manufacture, passed by an endless felt through a series of press rollers, successively, in the same way, by which it is experienced that the upper side being alone submitted to the action of the polished surface of the press roll, retains a greater degree of gloss than the under one which remains on the felt; one of his improvements consists in alternately reversing the sides of the paper as it passes through the rollers, in order to give it a uniform appearance; this he accomplishes by a combination of rollers and endless felt working in contrary directions. The second improvement consists in causing cotton, flaxen, or silken thread, web, or lace, to be introduced into the paper, in such way that they shall form the inner part: the advantage derived from such an operation he does not, however, state. The threads or other material being wound on bobbins, so arranged as to revolve and unwind the threads with facility, are placed over a roller having small semi-circular grooves in it, which conveys them to the roller of woven wire immersed in the pulp; they intermix with this substance, and the paper thus formed is conveyed by an endless felt to the pressing rollers, where, as well as in subsequent stages, it undergoes the same operation as on ordinary occasions. The threads may be placed at the distance of an eighth of an inch apart, or as may be thought proper. If lace or web be employed, a single bobbin of suitable dimensions must be used, in the same manner as those for the threads. The third improvement, as expressed by the title, consists in the mode of cutting the paper into sheets. This is effected by means of a swinging frame, worked by an eccentric alternately backwards and forwards; on the lower end of the frame is fixed a spindle having four or more circular cutters, placed at a proper distance apart, which come in immediate contact with an equal number of straight cutters that are fixed on a cast-iron table under the frame, and exactly parallel with the reel, from whence the paper is drawn. Between each stroke of the frame the paper is placed across the straight cutters by an attendant, and the machinery is so arranged as to allow an interval for this operation. As this last improvement may, with advantage, be combined with the first one, the patentee observes that the same power which turns the pressing, and other rollers, may be employed to propel the cutting frame. [1b.]

To ROBERT STIRLING, Clerk Minister of Galston, and JAMES STIRLING, Engineer of Glasgow, for their having invented, or found out certain improvements in Air Engines for moving machinery. Enrolled August, 1827.

THIS is an engine constructed in the same way as an ordinary steam engine, with a piston working up and down in a cylinder, from the reciprocating action of which power is intended to be obtained for giving motion to other machinery. Instead, however, of employing steam acting against a vacuum, as the agent for moving the piston, it is proposed in the present instance to employ volumes of hot and cold air; the dissimilar elastic forces of which applied alternately on opposite sides of the piston, raise and depress it.

The volumes of air by which the engine is to be worked are contained in two vessels placed near the engine, from each of which vessels there is a pipe leading to the cylinder; the one delivering the air above the piston, the other below it. The piston therefore is worked by forcing into the cylinder one of the volumes of air, while the other is allowed to escape out of it; and the mechanical force of the air is increased by heating the injected volume, and cooling that volume which is withdrawn.

To effect these objects, two distinct hemispherical or dome shaped furnaces are constructed, above each of which there is a corresponding hemispherical or dome shaped chamber, with cylindrical sides, containing the volume of air intended to be employed as the motive agent, and in each of the said chambers there is a piston, also hemispherically formed, exactly fitting the sides of the chamber, and working up and down therein for the purpose of expelling the air from the chamber into the cylinder of the engine.

The pistons of the two air chambers are to be raised and depressed alternately by a vibrating beam connected to the ends of their rods, which beam is to be actuated by some of the moving parts of the engine when set to work. The fires which are intended to burn with a uniform heat in the furnaces under each chamber, are for the purpose of causing the volume of air beneath each of the pistons to be heated, and of course its elastic force to be increased: while the volume above the piston becomes cooled by a blast of cold air, or a stream of cold water passed over the top of the chamber.

Depressing the piston in either of the air chambers, causes part of the volume of heated air beneath it to be forced through its pipe into the cylinder of the engine, and then to drive the piston by its elastic force, which act causes at the same time the piston in the other air chamber to rise, and thereby to draw off through its pipe the volume of air from the opposite side of the working piston.

The peculiar feature of novelty in this apparatus appears to be the construction of the pistons in the air chambers, by means of which a rapid change of temperature is effected in the air from hot to cold, and *vice versa*.

The air pistons formed, as before said, into hemispherical shapes,

are to be several inches in thickness, and constituted of several plates of metal with multitudes of small perforations in them. The plates are to be kept a little distance apart, either by indenting them, or by introducing small pieces of hard substances between the plates, and the whole of them being secured together constitute a colander, through which the air percolates with difficulty.

In the descent of either of the pistons, that part of the heated air which is not forced into the cylinder of the engine, passes upwards through the small holes of the piston, and becomes cooled by being brought in contact with the surface of the cold part of the air chamber, and the piston in rising again allows the air thus rendered cold to pass from the upper part of the chamber through the perforations of the piston to assist in cooling that portion of the volume of air which is being withdrawn from the cylinder.

In this way it is proposed alternately to change the temperature of the air in the two chambers with great rapidity, and taking advantage of the superior mechanical force of the air when heated, to employ it when driving the working piston of the engine.

[*London Journal.*

To JAMES STOKES, Merchant, for his invention of certain improvements, in making, boiling, clarifying or preparing raw, or Muscovado, Bastard Sugar, and Molasses. Enrolled April, 1828.

THE object of this invention is to prepare sugar from the cane juice or molasses, of a superior quality to that obtained by the ordinary process.

The juice, say one hundred gallons, being placed in a suitable vessel for clarification, add to it fourteen pounds of charcoal in a pulverized state; seven pounds of the bark of the wild elm, and one pound of lime. Mix them well together, and when settled, skim off the foul matter from the surface. Then filter the liquor through a blanket, as usual, and afterwards boil and evaporate it to a state of crystallization.

When the sugar has become cold, mix with one hundred weight of it, one gallon of brandy, rum, gin, or other spirituous liquor, and then by hydraulic pressure, or any other means, express the molasses, which renders it fit to be put into moulds, or into casks for the market.

In adapting part of this improved process to the clarification of bastard or brown sugar, mix with the sugar spirituous liquor in the above proportions, and press out the molasses as above described.

The patentee does not point out what part of this process he considers to be new; and for our part, we are unable to discover the novelty, as several of the materials mentioned, and the mode of applying them, have, if we mistake not, been long in use for the same purpose.

EDITOR. *Ib.*

To BARON CHARLES WETERSTEDT, for his invention of a *Liquid or Composition for water-proofing or strengthening Leather*. Enrolled December, 1828.

THIS composition for rendering leather water proof, is proposed to be made of the following materials:—

Of rosin take sixteen pounds, and of tallow five pounds, which are to be boiled together in one gallon of linseed oil until the rosin is perfectly dissolved, and mixed with the tallow and oil; to this, add one and a half pounds of spirits of turpentine, in which has been previously dissolved about an ounce and a half of caoutchouc, commonly called Indian rubber.

This composition is suited for rubbing into the soles of boots and shoes, and will render them perfectly water proof; but for the upper leathers of such articles, and for harness and other leather, the following composition is proposed:—

Take of neatsfoot oil one gallon, of tallow six pounds, of hogs' lard eleven pounds, and of bees' wax half a pound; which being boiled together until perfectly mixed, must be allowed to cool, and after its having become cold, add to the composition three pounds of spirits of turpentine, in which three ounces of caoutchouc (Indian rubber) has been dissolved.

The patentee has not stated what he claims as new in this composition. Our opinion is, that every one of the articles mentioned have been either applied to render leather water proof, or to form water proof substitutes for leather.

EDITOR. *Ib.*

To JOHN BRAITHWAITE and JOHN ERICSSON, *Engineers, for their new invented mode or method of converting Liquids into Vapour or Steam*. Enrolled July, 1829.

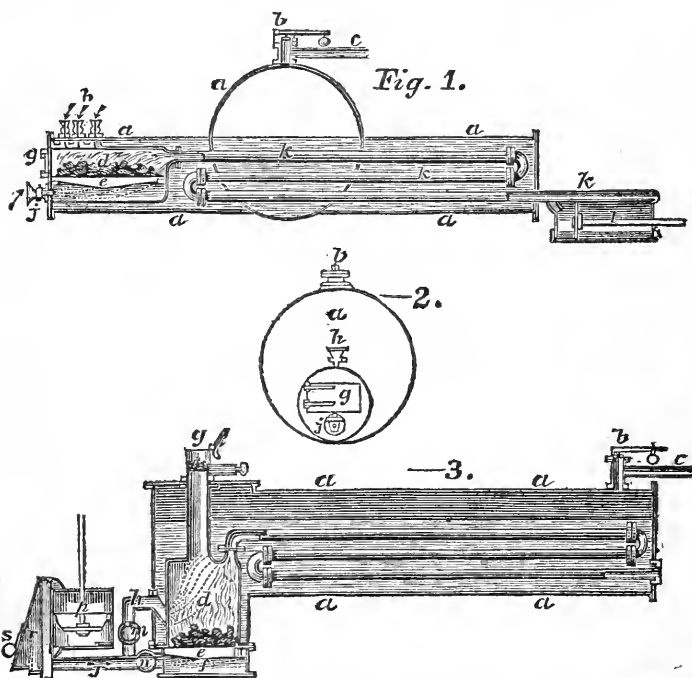
THE subject of this invention is a peculiar construction of boiler for generating steam, in which the heated air from the furnace is either drawn or forced through pipes of small diameter, which pipes constitute the flues, and are surrounded by the water contained within the boiler. By this contrivance, a very extended heated surface is placed in contact with the water, and steam is thereby generated with greater effect than in any other boiler heretofore employed for that purpose.

The peculiar construction of boiler herein proposed, is applicable to the working of any kind of steam engine; but it appears to be particularly designed for locomotive steam carriages, in which situation it has been found extremely effective.

The patentees describe their invention in the following words:—

Specification.—"Our said invention consists in generating steam in a boiler, wherein the capacity of the flue is too small to allow a sufficient quantity of heated air to pass through it in a given time by

the mere agency of what is commonly called atmospheric draught, and to which flue, therefore, we attach either an air-forcing at the furnace end, or an air-exhausting apparatus at the other end of the flue, in order, by these mechanical means, to compel the required quantity of heated air to pass through the flue in a given time, whereby we are enabled to expose a given surface of flue to such a quantity of caloric in a given time, as will generate more steam than has ever before been produced in an apparatus of equal capacity, and thus effect a great saving in fuel, and greatly diminish the size and weight of a boiler.



" Fig. 1, is a longitudinal section of a boiler for generating steam, according to the method which we claim as our invention, and through the flue of which the heated air is drawn, by means of an air-exhausting apparatus, which apparatus, for the purposes of this invention, we call an air-sucking pump; a, a, a, is the outer casing of the boiler; b, is the safety valve; and c, the steam pipe; d, is the furnace; e, one of the furnace bars; f, the ash pit; g, the furnace door; h, three air cocks, to admit atmospheric air to the top of the fuel in the furnace; j, an air cock, to admit atmospheric air to the bottom of the said fuel; k, k, k, k, the flue gradually diminishing in diameter from the furnace, in proportion as the heated air, cooling in its passage through the flue, gradually requires less vent; while another advantage of this form, is, that the dust and dirt of the fur-

nace have a constantly descending passage to escape at; which, together with the relative position of the different lengths of the flue being immediately under each other, prevents any inconvenience from dirt collecting in it.—*l*, is a double action air-exhausting pump, which we call the air-sucking pump; and it is evident, that if this pump be worked, any given quantity of heated air may be drawn through the flue from the furnace, in any given time proportionate to the action of the pump, the number or size of the air cocks, and the general dimensions of the apparatus. Fig. 2, is an end elevation of the boiler just described.

“Fig. 3, is a longitudinal section of a boiler for generating steam, according to the method which we claim as our invention, and through the flue of which the heated air is forced by means of an air-forcing apparatus, which apparatus, for the purposes of this invention, we call an air-forcing pump; *a, a, a*, is the outer casing of the boiler; *b*, the safety valve; *c*, the steam pipe; *d*, the furnace; *e*, a fire bar; *f*, the ash pit; *g*, a hopper, for feeding the furnace with fuel; *h*, an air pipe, furnished with a regulating cock *m*; through which atmospheric air is forced on to the top of the fuel; and *j*, is another air pipe, also furnished with a regulating cock, *n*, through which atmospheric air is forced to the bottom of the fuel; *p*, is an air-forcing apparatus, which we call an air-forcing pump, furnished with valves, as here shown, and an air regulator, *r*, being a board, inclosed in a leather case, and acted upon by the weight *s*.

“It will be evident that this boiler, as far as the principle of our invention is concerned, will produce the same effect in generating steam, as that first described, the difference therein being merely in the mode of obtaining the required velocity for the heated air in its passage through the flue; but it is worthy of remark, that the modifications necessary to the adaptation of the principle of our said invention to these two forms of boilers, render them respectively the better available for different purposes.

“In Fig. 1, it will be observed that the furnace is horizontally placed, and may be fed from a door in the front, as at *g*, in the ordinary way, while at Fig. 3, the furnace is vertically placed, and must be fed from a hopper, as shown in the figure.

“Now, whereas we claim as our invention the converting of liquids into vapour or steam, by means of a boiler, wherein the capacity of the flue is too small to allow a sufficient quantity of heated air to pass through it in a given time, by the mere agency of what is commonly called atmospheric draught, and to which, therefore, either an air-exhausting apparatus, or the air-forcing apparatus hereinbefore described, is applied for that purpose, it being our intention to claim as new the application of an air-exhausting apparatus generally for such purpose; and the particular air-forcing apparatus hereinbefore described, whereby, as well as in the air-exhausting apparatus, the fuel is supplied with air both above and below, as shown in the drawing annexed, which, double supply of air, regulated by cocks as aforesaid, we claim also as new.” [Ib.]

Account of the performance of various Rail-road Carriages on the Liverpool and Manchester Rail-road.

Grand Mechanical Competition—Rail-road Race for £500.—The great rail-road between Liverpool and Manchester being now nearly completed, the directors of the undertaking, some time ago, announced that they would give a premium of £500 for the locomotive engine, which should, at a public trial to be made on the 1st of the present month of October, (afterwards postponed to the 6th) draw on the rail-way a given weight with the greatest speed at the least expense. The offer of so handsome a premium, and the brilliant professional prospects which the winning of it presented to mechanical men, naturally excited a very lively spirit of competition among them. In almost every quarter of the country, engine makers and engine inventors set themselves to work to secure the prize; and the result, we are happy to say, has been such as to furnish a lasting example of the wisdom of calling into action, and giving fair play, to *the general talent of a country*, when any great public object has, as in the present instance, to be accomplished.

At all hands, the directors of the Liverpool and Manchester railway, deserve thanks for their conduct on this occasion; from their constituents, for the good sense and liberality which dictated a competition by which the capability of the rail-way, to do all that was promised, and much more, has been at once placed beyond all doubt, and the chances of a profitable return for the money invested in it increased at least tenfold; from the owners of the competing engines, for the liberal encouragement by which they were induced to *start for the plate*, and the impartial spirit, (divested of all local and personal influences) in which the competition has been conducted; and from the nation at large, for the powerful impulse which this demonstration of the extraordinary celerity with which carriages may be propelled on rail-ways, must give to the more extensive adoption of this mode of conveyance throughout the kingdom.

The principal conditions on which the prize was offered, were these:—1st. That each engine entered for the competition should weigh not more than six tons, and be capable of drawing after it, day by day, on a level plain, a train of carriages of a gross weight, equal to three times the weight of the engine itself, at a rate of not less than ten miles per hour, with a pressure of steam in the boiler not exceeding 50lb. on the square inch. 2. That the engine and boiler should be supported on springs, and rest on six wheels, and the height from the ground to the top of the chimney should not exceed fifteen feet. 3. That the engine should “effectually consume its own smoke;” and 4. That there should be two safety valves, one of which should be completely out of the reach of the engine man’s interference.

The gentlemen appointed by the directors to act as judges on the occasion, were J. U. Rastrick, Esq. of Stourbridge, civil engineer, Nicholas Wood, Esq. of Killingworth, civil engineer, (author of the excellent work on rail-ways) and John Kennedy, Esq. of Manchester.

The portion of the rail-way chosen for the "running ground," was on the Manchester side of Rainhill Bridge, (about nine miles from Liverpool) where the rail-way runs for two or three miles on a dead level.

Early on Tuesday, the day of competition, great crowds of people were assembled from all parts, to witness the sight. There were many individuals who had come hundreds of miles for no other purpose; and, as may readily be supposed, these were not idle spectacle hunters, but chiefly engineers and men of science capable of appreciating, in its full extent, the great importance of the exhibition.

The number of competitors was at first reported to be ten, and we have reason to know there was at least as many engines as this in preparation. In this new sort of race, however, as in others, there were some withdrawn, and some prevented by accidents from making their appearance; and the number was reduced, on the morning of trial, to five, which were thus described in the official list of the *running coaches*:—

No. 1. Messrs. Braithwaite and Ericsson, of London; "The Novelty;" copper and blue; weight, 2 tons, 15 cwt.

2. Mr. Ackworth, of Darlington; "The Sans Pareil;" green, yellow, and black; weight, 4 tons, 8 cwt. 2 qrs.

3. Mr. Robert Stephenson, Newcastle-upon-Tyne; "The Rocket;" yellow and black; white chimney; weight, 4 tons, 3 cwt.

4. Mr. Brandreth, of Liverpool; "The Cycloped;" weight, 3 tons; worked by a horse.

5. Mr. Burstall, Edinburgh; "The Perseverance;" red wheels; weight, 2 tons, 17 cwt.

The engine which made the first trial, was the "Rocket" of Mr. Robert Stephenson (the son, we believe, of Mr. George Stephenson, the engineer of the rail-way.) It is a large and strongly built engine, and went with a velocity, which, as long as the spectators had nothing to contrast it with, they thought surprising enough. It drew a weight of twelve tons, nine cwt. at the rate of ten miles four chains in an hour, (just exceeding the stipulated minimum,) and, when the weight was detached from it, went at a speed of about eighteen miles an hour. The faults most perceptible in this engine, were a great inequality in its velocity, and a very partial fulfilment of the condition, that it should "effectually consume its own smoke."

The next engine that exhibited its powers was "The Novelty" of Messrs. Braithwaite and Ericsson. The great lightness of this engine, (it is about one-half lighter than Mr. Stephenson's) its compactness, and its beautiful workmanship, excited universal admiration; a sentiment speedily changed into perfect wonder, by its truly marvellous performances. It was resolved to try first its speed merely; that is, at what rate it would go, carrying only its complement of coke and water, with Messrs. Braithwaite and Ericsson to manage it. Almost at once, it darted off at the amazing velocity of twenty-eight miles an hour, and it actually did one mile in the incredibly short space of one minute and 53 seconds! Neither did we observe any appreciable falling off in the rate of speed; it was

uniform, steady, and continuous. Had the rail-way been completed, the engine would, at this rate, have gone nearly the whole way from Liverpool to Manchester within the hour; and Mr. Braithwaite has, indeed, publicly offered to stake a thousand pounds, that as soon as the road is opened, he will perform the entire distance in that time.

It was now proposed to make a trial of the "Novelty," with three times its weight attached to it; but through some inattention as to the supply of water and coke, a great delay took place in preparing it for its second trip; and by the time all was ready, the day was drawing so near to a close, that the directors thought it proper to defer the prosecution of the competition till the following day.

[*Mechanics' Magazine*, October 10.]

In our last number we gave an account of the commencement of this interesting and important competition. We now propose to resume the subject *de novo*, and to go into it with all the fulness and circumstantiality which it so pre-eminently deserves.

It may be necessary for the information of some of our readers, to premise, that though rail-ways have been for more than a century in use in Great Britain, and are now extremely numerous, the one which has been the scene of the present competition, is but the third which has been constructed in Great Britain for general use; that is to say, with the view of superseding, entirely, the employment of ordinary roads, by the public at large, as far as carriages of all descriptions are concerned; and that down to the day of this competition, it was still a question of some doubt whether a rail-way could be produced possessed of such extensive capabilities.

The first undertaking of the kind was the Surrey Rail-way, designed by Mr. Jessop; but the only use as yet made of that road has been for the conveyance, by horses, of heavy goods, at a rate of three or four miles per hour; and in consequence of its passing through a country of little traffic, it has rather disappointed the expectations of its projectors.

The second was the Stockton and Darlington Rail-way, on which steam power was, for the first time, employed to propel passengers, as well as goods, and with a degree of success which began to open the eyes of the public to advantages of which they had not even dreamt, in connexion with rail-way conveyance. It was here proved that by the employment of steam carriages, a speed of from five to eight miles an hour, according to the weight drawn, was readily attainable; and that the expense of this mode of conveyance was one-half, in some instances two-thirds cheaper than any other. Inside passengers were conveyed at the rate of $1\frac{1}{2}d.$ per mile; outsiders, $1d.$; and the price of coals, which used at Stockton to be $15s.$ and $17s.$ per ton, was all at once reduced to $10s. 2d.$ From the 29th of September, 1825, when this rail-way opened, to the 29th of September, 1826, its receipts increased progressively from £700 to £1500 a month; and in the second year it had drawn to it nearly the whole

carrying trade between Stockton, Richmond, Darlington, Yarm, &c. The turnpike road, too, which may be said to have been thus beaten out of the field, is actually four miles shorter than the rail-way; for to accommodate Darlington and Yarm, a more circuitous line was taken than would otherwise have been necessary.

As early as 1822, and of course long before these favourable results were known, the Liverpool and Manchester Rail-way had been projected by William James, Esq., Civil Engineer, and all the necessary surveys for it made by Mr. Vignoles, another able and intelligent member of the same profession; but in consequence of the strong opposition which was threatened by the whole body of canal proprietors throughout the kingdom, and other causes, the prosecution of the design languished till the progress of the Stockton and Darlington Rail-way towards completion; and the success of some preliminary trials upon it, animated the people of Lancashire with a new zeal in behalf of their own speculation. A deputation of gentlemen was appointed, consisting of Messrs. Ellis, Sanders, and Booth, of Liverpool, and Mr. Kennedy, of Manchester, to proceed to the north to inspect the Stockton and Darlington Rail-way, and also some collieries, in the north of England, where locomotive steam engines have for several years been employed to transport the coal wagons to the nearest land or water communication. The report made by this deputation was so satisfactory, that it was immediately determined to prosecute the plan of the Liverpool and Manchester Rail-way with the greatest vigour: the whole capital required was subscribed within a few weeks; and in the following session of parliament, an act was obtained containing all the requisite legal powers. The act met, as had been anticipated, with a great deal of opposition; but as that opposition had no better foundation than the resistance made by the land carriers of a preceding age to the introduction of canals, it necessarily shared a similar fate. The marquis of Stafford, who was at first its most powerful opponent, became at length so satisfied of the superior advantage which it promised to confer on the country, that his lordship not only withdrew his opposition, but purchased a thousand shares in the concern.

In the summer, or rather autumn of 1826, the formation of the rail-way commenced under the direction of Mr. George Stephenson, of Newcastle-upon-Tyne, who had been appointed by the company to carry the design of Mr. James into execution. The natural character of the country through which the road passes, made the undertaking one of considerable difficulty, as will be readily perceived from a simple detail of the work which Mr. Stephenson had to perform. There were, first, two tunnels, one 2200 yards, and the other 291 yards long, to be excavated under the town of Liverpool, and afterwards six considerable eminences to be cut through; these excavations, too, had mostly to be made through solid rock, (red sandstone,) and amounted altogether to upwards of two millions of cubic yards. While in some parts it was thus necessary to hew out a level with the pickaxe; there were others where the level had to be maintained by raising artificial mounds, (or embankments as they are less

properly called) bridges, and viaducts. One of these mounds, called the Broad Green Embankment, rises to an elevation of 70 feet above the level of the surrounding country; another, which is about four miles long, extends over a moss (Chatmoss) which, three years ago, was scarcely passable even to pedestrians. Of bridges and viaducts the number required to be erected on the line was 25; one of which (the Sankey) was to consist of nine arches of fifty feet span, and another (the Newton) of four arches of thirty feet span; besides which, there were to be 36 culverts of large dimensions, with several of a smaller size. When we consider the great number and variety of these works, the difficulty of some, and the stupendous nature of others, it is really wonderful to think how much has, within the space of three brief years, been accomplished. Both the tunnels, all the bridges but one (that over the Irwell,) and all the culverts, have been already finished; and so nearly have the different mounds and excavations been likewise completed, that of thirty-three miles, (the estimated length of the rail-way) only about four miles remain to be executed. We need scarcely say how greatly all this redounds to the honour of the engineer. So much work of a difficult description could not have been performed in so short a time, (and it is but fair to add so well,) unless the labour bestowed on it had been under most intelligent direction. There are some things which are mere works of time; but here we see art triumphing over time; the labours of the head far transcending those of the hand.

It is now understood that early in the spring of next year, the whole of the rail-way from Liverpool to Old Field Road, near the site of the intended bridge over the Irwell, will be ready for travelling on; and that the opening may not be deferred till the erection of that bridge, it is proposed to erect a wharf and warehouses at Old Field Road, where the rail-way will be considered to terminate, until the continuation of the line into Manchester is completed.

The rails have been as yet laid down on about fourteen miles of the road only; but as this is a matter which requires little time, no delay is apprehended on this account. The sort of rail employed is that called the edge-rail, in contradistinction to the flat rail or tram-plate, now so generally abandoned, where ease of draught is consulted; not however the common edge-rail, but that particular description for which Mr. Birkinshaw, of the Bedlington Iron Works, has a patent. The following description of the construction and advantages of these rails we extract from the Supplement to the Encyclopædia Britannica:—

“The flat rail has been now almost entirely superseded by the edge-rails, which are generally admitted to be decidedly superior; the edge of the bar presenting less friction, and being less liable to clog up with dust and mud, or to be obstructed with stones driven off the road upon the surface of the rails. The edge-rail consists merely of a rectangular bar of cast-iron, three feet long, three or four inches broad, and from one-half inch to one inch thick; set on its edge between sleeper and sleeper, and bearing on the sleepers at its extremities. The upper side of the rail is flanché out to pre-

sent a broader bearing surface for the wheels, and the under side is also cast thicker than the middle for the sake of strength. But the greatest strength is evidently attained by casting the rail not rectangular, but deeper in the middle than at the ends, to resist better the transverse strain. The ends may be safely reduced to nearly one-third of the depth in the middle, and still be equally strong. To unite the rails together, and at the same time preserve them in their places, and in their upright position, and also to bind them to the sleepers, they are set in a cast-iron socket or chair, which is attached firmly to the sleeper. This socket embracing the extremities of the adjacent rails, which are here made to overlap a little, a pin is driven at once through the rails and through the socket, and binds the whole together. This is the general method of uniting the edge-rails; but the shape and dimensions of the metal chair and of the overlap of the rails are varied according to the judgment and taste of the engineer. Since edge-rail-ways have come into more general use, an essential improvement has been made in their construction by the use of malleable iron, in place of cast-iron, in forming the rails. The advantage of malleable iron rails is, that they are less subject to breakage than cast-iron, a circumstance of importance in this case, where it is not easy to avoid those jolts and sudden shocks which cast-iron is least of all capable of withstanding; and though they should happen to give way, they are easily repaired. They can also be laid in greater lengths, and requiring therefore fewer joints; they can be bent with ease to the curvature of the road: when worn out they are of greater value; and, lastly, their first cost is very little, if at all, greater than that of the cast-iron rails. Malleable iron is, no doubt, less able to stand exposure, decaying more readily under the influence of air and moisture; but hitherto this inconvenience has not been felt; and on the whole, the malleable iron is now decidedly preferred. These rails are laid and joined in the same manner as the cast-iron, only in greater lengths."

The writer then proceeds to describe Mr. Birkinshaw's improvement—

"An improvement has lately been made in the construction of malleable iron-rails, which promises to be of essential utility. It consists in the use of bars, not rectangular, but of a wedge form, or swelled out on the upper edge. In the rectangular bar, there is evidently a waste of metal on the under surface, which, not requiring to be of the same thickness as where the wagon-wheel is to roll, may be evidently reduced with advantage, if it can be done easily. The bar may then be made deeper, and broader at the top than before, so as with the same quantity of metal to be equally strong, and present a much broader bearing surface for the wheel. The peculiar shape is given them in the rolling of the metal, by means of grooves cut in the rollers, corresponding with the requisite breadth, and depth, and curvature of the proposed rail. Mr. B. recommends the rails to be of eighteen feet in length. We have seen one of these patent rails at Sir John Hope's colliery; and it certainly forms the most perfect iron rail which has hitherto been contrived; combining very simply

and ingeniously, in its form, the qualities of lightness, strength, and durability. It is twelve feet long, two inches broad along the top, about half an inch along the bottom, and still thinner between. It rests on sleepers at every three feet, and at those places the rail is two inches deep, while in the middle point between the sleepers it is three inches deep. All these inequalities, we believe, are produced on the metal by means of the rollers; and this circumstance is well deserving of attention, as it may obviously be applied not merely in the formation of rail-ways, but to a variety of other purposes in the arts. The moulding and shaping of the metal in this manner is quite a new attempt in the iron manufacture, and it is not easy to say how far such an invention may yet be carried by the skill of British artists."

Mr. Stephenson, it will be seen, had good reason for the preference he has given to Mr. Birkinshaw's rails. An engineer of great experience whom we met at the present competition, suggested what we think would be a great improvement in them; namely, that they should overlap at the extremities, in the same way, in fact, as most of the old edge-rails did. The advantage of an unbroken continuity in the bearing surface seems not to have been sufficiently consulted.

The total cost of the rail-way is not expected to be much less than £650,000, or about £20,000 per mile. This is much more than was ever before expended on a rail-way; but the excess is to be accounted for partly by the number of deep cuttings, lofty embankments, &c., which were necessary, and partly by the circumstance, that compensation had to be made to the proprietors of the ground assumed for the purposes of the rail-way, while in most other cases there has been no need of such compensation; rail-ways being, nine times out of ten, constructed by individual proprietors on their own lands, and for their own exclusive benefit. Were the expense, however, even to exceed £650,000—nay, to be even twice or thrice as much—we are convinced there will be revenue enough to yield a handsome return. The traffic between Liverpool and Manchester is probably greater than what exists between any other two points of the kingdom. The one being the principal port for the importation of cotton, and the other the chief seat of its manufacture; this alone serves to unite them in bonds of the closest alliance. The total quantity of merchandise passing between the two towns is stated to be 1200 tons per day; and though it is not to be expected that the same result will take place here as has been exhibited in the case of the Stockton and Darlington rail-way, (for the Liverpool and Manchester rail-way will still have the Irwell and Mersey navigation to contend with, and probably at reduced rates,) yet if only one half of this immense traffic is transferred to the rail-way, it will at 2*d.* per ton each mile, yield an annual income of £52,478 13*s.* 4*d.* The carriage of passengers may reasonably be expected to add to this sum at least £25,000 more.

The profit to be derived by the share holders, forms, however, but a minor consideration, compared with the vast advantages that will result to the inhabitants of Liverpool and Manchester, and indirect-

ly to the nation at large, from increasing the celerity and cheapness of communication between the two towns. But to appreciate duly what is likely to be effected in these respects on this new line, we must pause a moment to reflect on what was the maximum of effect previously realized on the Stockton and Darlington rail-way. It was not more, as we have before stated, than eight miles an hour; and the idea of any thing much beyond that rate was generally scouted as visionary. Mr. Wood, who published his book on rail-ways, after the opening of the Stockton and Darlington rail-way, was pleased to say, "It is far from my wish to promulgate to the world that the *ridiculous* expectations, or rather *professions* of the enthusiastic speculatist will be realized, and that we shall see engines travelling at the rate of *twelve, sixteen, eighteen, or twenty* miles an hour. Nothing could do more harm towards their adoption or general improvement than the promulgation of such *nonsense!*" The directors of the Liverpool and Manchester rail-way appear to have had nearly the same impressions when they offered the present premium of £500 for "the most improved locomotive engine." They stipulated that it should be "capable of drawing after it day by day on a well constructed rail-way, on a level plain, a train of carriages of the gross weight of 20 tons, including the tender and water-tank, at the rate of *ten miles per hour.*" More they did not ask for; and as if to evince how perfectly they agreed with Mr. Wood as to the "nonsense" of expecting more, they selected that gentleman to be one of the judges of their competition.

The proceedings on this first day of the competition are already before our readers. It has been seen from them that Mr. Wood has been spared to see, not only what he declared to be "ridiculous" and "nonsense," reduced to an unquestionable matter of fact, but of witnessing something so much more extraordinary, that had any one hinted it to him in his days of incredulity, he would, we presume, have pronounced it to be absolute madness. The least powerful of the two engines then exhibited, reached nearly the highest degree in Mr. Wood's scale of "nonsense," having gone without any load, at the rate of about eighteen miles an hour; while "The Novelty" of Messrs. Braithwaite and Ericsson actually realized almost double that speed!

"When we consider," says a writer, in the Liverpool Chronicle, "that at this rate of going, Liverpool and Manchester, which are at present near half a day's journey distant, will be brought within an hour's travel of each other; and pass from this fact to the contemplation of the vast changes which so rapid a mode of conveyance will effect in all the relations of society in this quarter of the kingdom, we feel at a loss for examples with which to contrast this great triumph of human ingenuity." But suppose we go a step farther, and estimate what the effects will be, of extending this system of communication over the whole kingdom; what mind is there so comprehensive as to embrace all the important consequences to which it will lead? We think we shall not go too far in saying, that it will produce an entire change in the face of British society. The effect

will be much the same, as if the work-shop of the manufacturer were brought along-side the quay where he obtains his raw material, and whence he sends it forth again in a manufactured shape to the most distant parts of the world; or as if the collieries, iron mines, and potteries of the heart of England were scattered along its shores. Peculiar local advantages will figure less than they have done in our manufacturing and commercial history; since whatever one place produces, can be so quickly and cheaply transported to another; and instead of our manufactures continuing concentrated in two or three of our large towns—to the great injury of the moral and physical condition of those employed in them, we may expect to see them spreading gradually over the whole kingdom. *Living in the country*, will no longer be a term synonymous with every sort of inconvenience; and it will come to be a mere matter of choice, whether a man of business lives close by his counting-house, or thirty miles from it. The rents of land and houses will not be raised by the change, but they will be equalized; they will be reduced in town, and raised in the country. In proportion, too, as the intercourse of men with each other, and the interchange of commodities between them is thus facilitated, the greater will be the cheapness of every thing; the more our manufacturers will have it in their power to bear up against that foreign competition, by which they are so much endangered. The oftener (to use a common phrase) the penny is turned, the greater the profit; and the quicker a trader's returns, the smaller the capital he requires in business. In fine, we may say of rail-ways in general, as a worthy gentleman is said to have observed of the Stockton and Darlington line, and with ten times greater probability of seeing our prophesy realized—"Let the country but make the rail-roads, and the rail-roads will make the country."

Wonderful as were the results which have suggested these observations, they were abundantly confirmed by the farther experiments which we now proceed to detail.

Second Day, 7th October.—"The Novelty" engine of Messrs. Braithwaite and Ericsson was this day tried with a load of three times its weight attached to it, or 11 tons, 5 cwt.; and it drew this with ease at the rate of $20\frac{3}{4}$ miles per hour; thus proving itself to be equally good for speed as for power. We took particular notice to-day of its power of consuming its own smoke, and did not at any time observe the emission of the smallest particle from the chimney. The weather now became wet, and the rail-ways clogged with mud, which made it necessary to suspend the prosecution of the experiments before the day had half elapsed.

Third Day, 8th October.—Before the commencement of the experiments to day, it was announced that the judges, on reconsidering the card of "Stipulations and conditions" originally issued, had considered them so defective, as to make it necessary to substitute the following:—

"*Trial of the Locomotive Engines.—Liverpool and Manchester Rail-Way.*

"The following is the Ordeal which we have decided each Loco-

motive Engine shall undergo, in contending for the Premium of £500, at Rainhill.

“The weight of the locomotive engine, with its full complement of water in the boiler, shall be ascertained at the weighing machine, by eight o’clock in the morning, and the load assigned to it shall be three times the weight thereof. The water in the boiler shall be cold, and there shall be no fuel in the fire-place. As much fuel shall be weighed, and as much water shall be measured and delivered into the tender-carriage, as the owner of the engine may consider sufficient for the supply of the engine for a journey of thirty-five miles.

The fire in the boiler shall then be lighted, and the quantity of fuel consumed for getting up the steam shall be determined, and the time noted.

“The tender carriage, with the fuel and water, shall be considered to be, and taken as a part of the load assigned to the engine.

“Those engines that carry their own fuel and water, shall be allowed a proportionate deduction from their load, according to the weight of the engine.

“The engine, with the carriages attached to it, shall be run by hand up to the starting-post; and as soon as the steam is got up to fifty pounds per square inch, the engine shall set out upon its journey.

“The distance the engine shall perform each trip, shall be one mile and three quarters each way, including one eighth of a mile at each end for getting up the speed, and for stopping the train; by this means the engine, with its load, will travel one and a half mile each way, at full speed.

“The engine shall make ten trips, which will be equal to a journey of thirty-five miles; thirty miles whereof shall be performed at full speed, and the average rate of travelling shall not be less than ten miles per hour.

“As soon as the engine has performed this task, (which will be equal to the travelling from Liverpool to Manchester,) there shall be a fresh supply of fuel and water delivered to her; and as soon as she can be got ready to set out again, she shall go up to the starting-post, and make ten trips more, which will be equal to the journey from Manchester back again to Liverpool.

“The time of performing every trip shall be accurately noted, as well as the time occupied in getting ready to set out on the second journey.

“Should the engine not be enabled to take along with it sufficient fuel and water for the journey of ten trips, the time occupied in taking in a fresh supply of fuel and water, shall be considered and taken as a part of the time in performing the journey.

Judges.—J. U. Rastrick, Esq. Stourbridge, C. E.—Nicholas Wood, Esq. Killingworth, C. E.—John Kennedy, Esq. Manchester.

“Liverpool, Oct. 6th, 1829.”

We shall not go into a question which has been raised, as to the fairness of the judges making any alteration in the conditions originally promulgated. We have a perfect persuasion that they have

no other desire than to ascertain in the best manner possible, the relative powers of the competing engines, and shall not quarrel with them for any mere irregularity in the mode of their proceedings. The "new" appears to us to be also, on the whole, a "much amended" edition.

In the original "stipulations and conditions," it was first ordered, that "the load attached to each engine should be three times the weight of the engine;" and then, that the load drawn should be equal to "twenty tons, including the tender and water-tank." To reconcile these contradictory stipulations, and to make provision for the case of an engine carrying (as Messrs. Braithwaite and Ericsson's does,) its own fuel and water, and therefore not requiring any tender, the matter of weight was thus arranged in the new conditions: "The tender-carriage, with the fuel and water, shall be considered to be, and taken as a part of the load assigned to the engine." And "those engines that carry their own fuel and water, shall be allowed a proportionate deduction from their load according to the weight of the engine." At first sight these seem very fair conditions; and we have no doubt the intention of them was to do equal justice to all parties. When attentively examined, however, they will be found to have this defect—that they serve to place the steam-carriage, which uses a great deal of water and fuel, on the same level with one which uses very little; though a diminution of fuel and water consumed, is one of the most important improvements which can be introduced into a locomotive engine. As the judges could have no other intention than to place all parties on equal terms, they would have done better simply to stipulate, that "the weight of each engine should be considered to consist of its entire working power; that is, of the whole of the machinery, and the whole of the materials necessary for putting it in motion." The matter would then have been placed on its only just basis; and there would have been no chance of any arithmetical mystification in the results.

Another alteration relates to the pressure of steam which was to be allowed. It was at first stipulated that "the pressure of steam in the boiler should not exceed 50 lbs. on the square inch;" but in the new conditions all that was required was, that "as soon as the steam has got up to 50 lbs. per square inch, the engine shall set out on its journey." We think this alteration was a very expedient one. We know not how the pressure could have been constantly kept at just 50 lbs.; and are quite sure that it would have been very unjust to withhold the prize from a competitor, because he might occasionally exceed that maximum.

Nothing was said in the new conditions as to each engine's "effectually consuming its own smoke;" but this omission could only have arisen from oversight; for the act of Parliament, under the authority of which the rail-way has been formed, orders imperatively that no engine shall be suffered to ply upon it which does not possess this qualification.

Having set these preliminary matters to rights, we now proceed with our narrative of the experiments.

The engine which exhibited on this, the third day, was "The Rocket," of Mr. Stephenson. The trial was conducted in the manner laid down in the "Ordeal" we have just quoted; and it was understood on all hands, that this trial should be considered decisive of its merits.

The engine, with its complement of water in the boiler, weighed 4 tons, 5 cwt. and the load attached to it was 12 tons, 15 cwt., or, including a few persons who rode, about 13 tons. The journey was $1\frac{1}{2}$ mile each way, with an additional length of 220 yards at each end to stop the engine in, making in one journey $3\frac{1}{2}$ miles. The first experiment was for 35 miles, which is exactly 10 journeys, and, including all the stoppages at the ends, was performed in 3 hours and 10 minutes, being upwards of 11 miles an hour. After this a fresh supply of water was taken in, which occupied 16 minutes; when the engine again started, and ran 35 miles in 2 hours and 52 minutes, which is upwards of 12 miles an hour, including all stoppages. The speed of the engine, with its load, when in full motion, was, at different times, 13, $13\frac{1}{2}$, 14, and 16 miles an hour; and had the whole distance been in one continued direction, there is little doubt but the result would have been 15 miles an hour. The consumption of coke was on an average about half a ton in the 70 miles.

Fourth Day, 9th October.—To-day a public notice appeared from Messrs. Braithwaite and Ericsson, stating, that in consequence of the alterations made in the conditions of the competition, the trial of their engine in the manner prescribed by the new "Ordeal," had, with the approbation of the judges, been deferred till the following day. The 9th became thus a *dies non* in the competition.

Fifth Day, 10th October.—At the appointed hour this morning "The Novelty" was weighed, and three times its weight assigned to it by the judges. The steam was got up in 54 minutes from the time of lighting the fire. The engine then went one trip by way of rehearsal, when a small pipe accidentally gave way, and it was found necessary to send to Prescott, a distance of two miles, to have it repaired.

In the interval, Mr. Stephenson's locomotive engine was run twice down the course and back, making in all seven miles, but with the whole load taken off from behind, including even the tender carriage with the water-tank and fuel. Thus *stripped for the race*, "The Rocket" performed the seven miles in the space of 14 minutes 14 seconds, being at the rate of 30 miles an hour! This was a rate of speed nearly equal to the utmost which "The Novelty" had achieved; but as it carried with it neither fuel nor water, it is not a speed which it could have long sustained.

Sixth Day, 13th October.—Mr. Acworth's engine, "The Sans Pareil," was pronounced to be this day ready to exhibit its powers. We were informed that, on weighing it, the judges found it to exceed by two or three hundred weight the maximum of six tons; it was, nevertheless, allowed to start to do 70 miles, in the same manner as "The Rocket," with three times its great weight attached to it—that is, upwards of eighteen tons. It was soon manifest that a very powerful competitor had entered the field. For two hours "The Sans Pa-

reil" kept going with great regularity, and during that time completed upwards of 25 miles. It went occasionally, when at its utmost speed, a mile in 4' 10" and 4' 17", being at the rate of nearly 15 miles an hour. While thus bidding fair—if not to win the prize; at least to come in second best—a similar accident happened to it as befel "The Novelty;" one of the feed pipes burst, and it was rendered for the time incapable of proceeding.

Seventh Day, 14th October.—It being generally understood that this was to be a day of a more decisive trial of Messrs. Braithwaite and Ericsson's engine—that is, according to the new conditions named by the judges—there was almost as numerous an assemblage of spectators as on the first day of the competition.

A fresh pipe had, it appeared, been substituted for the one which failed on the preceding trial; one or two other parts of the machinery that were in a faulty state, had also been renovated; but the engine, with the exception of some of the flanges of the boiler, being, as Mr. Ericsson expressed it, rather *green*, was pronounced in a working state. The load assigned to it by the judges was thus calculated:

	Tons.	Cwts.	qrs.	lbs.
Weight of the engine, without any water or fuel	2	15	0	0
Deduct for weight of tank and coke-baskets, and the quantity of water and fuel deemed necessary for a journey of 35 miles	0	16	1	9
Net weight of "The Novelty's" working power, exclusive of the water and fuel, tank, &c.	1	18	2	19
× by				3
Given weight to be drawn, dropping the fractional parts	5	16	0	0

The steam was on this occasion got up to a pressure of 50 lbs. in somewhat less than 40 minutes, and at an expenditure of about 15 lbs. of coke.

The engine now started to do the 70 miles for a continuance; but just as it had completed its second trip of three miles, when it was working at the rate of 15 miles an hour, the new cement of some of the flanges of the boiler, yielded to the high temperature to which it was exposed, and the spectators had again the mortification to hear it announced that it was, under these circumstances, impossible the trial could go on.

Messrs. Braithwaite and Ericsson intimated to the judges, that as the joints of "The Novelty" which had given way, could not be restored to a working state before the lapse of at least eight days, and the prolongation of the competition was likely to be attended with great inconvenience to many parties, they would withdraw their engine from any further trial, and "leave it to be judged of by the performances it had already exhibited." The manner in which this virtual conclusion to the proceedings has been announced by one of the Liverpool papers, is so distinguished by its fairness and liberality,

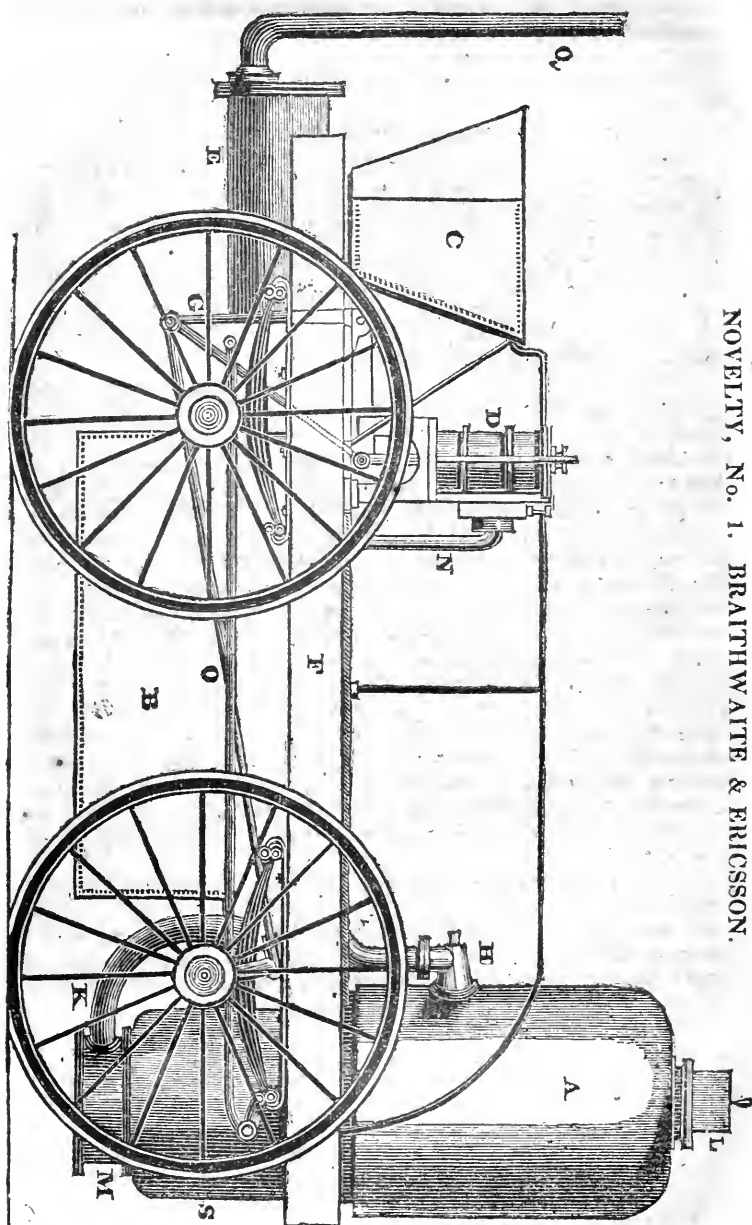
that we cannot deny ourselves the pleasure of making the following quotation from it on the subject:—

[From the Liverpool Mercury.]

“We may consider the trial of the Locomotive engines as now virtually at an end. It is much to be regretted that ‘The Novelty’ was not built in time to have the same opportunity of exercising that Mr. Stephenson’s engine had, or that there is not in London or its vicinity, any rail-way where experiments with it could have been tried. It will evidently require several weeks to perfect the working of the machine, and the proper fitting of the joints, and under this impression Messrs. Braithwaite and Ericsson have acted wisely in withdrawing, as they have done, from the contest.

“The course is thus left clear for Mr. Stephenson; and we congratulate him, with much sincerity, on the probability of his being about to receive the reward of £500. This is due to him for the perfection to which he has brought the old-fashioned locomotive engine; but the *grand prize of public opinion* is the one which has been gained by Messrs. Braithwaite and Ericsson, for their decided improvement in the arrangement, the safety, simplicity, and the smoothness and steadiness of a locomotive engine; and however imperfect the present works of the machine may be, it is beyond a doubt—and we believe we speak the opinion of nine-tenths of the engineers and scientific men now in Liverpool—that it is the principle and arrangement of this London engine which will be followed in the construction of all future locomotives. The powerful introduction of a blast bellows, the position of the water-tank below the body of the carriage, by which means the centre of gravity is brought below the line of central motion, the beautiful mechanism of the connecting movement of the wheels, the absolute absence of all smell; smoke, noise, vibration, or unpleasant feeling of any kind, the elegance of the machinery, in short, the *tout ensemble* proclaim the perfection of the principle.

“In withdrawing so honourably from the competition, Messrs. Braithwaite and Ericsson have done themselves the highest credit; and they may rest assured that the scientific world will do justice to their efforts, and look with anxiety to a speedy completion of their elegant and compact engine prepared to bear the fiercest ‘ordeal’ which the judges may please to direct.”



Description of the Competing Engines.

1. THE NOVELTY.

The external view of "The Novelty," will at once satisfy our readers, that it has not been unmeritedly extolled by all who have seen it, for its singular lightness, elegance, and compactness. All locomotive engines have been hitherto so constructed as to require a separate tender to carry the water and fuel necessary for these operations (we cannot as yet except Mr. Gurney's;) but "The Novelty" includes within itself every necessary accommodation for these purposes, and is, nevertheless, much lighter than any engine on the old plan. "The Rocket," of Mr. Stephenson, which is one requiring a separate tender, weighs 4 tons 3 cwt., while "The Novelty" weighs only 2 tons 15 cwt.; making a difference in favour of the latter of 1 ton 8 cwt.

There have been people so absurd as to say there can be nothing gained by so great a reduction in the weight of an engine as this; that it is "something like substituting a Scotch galloway for a good team-horse; because the lighter the engines are, the weaker." We do not dispute that there is a limit beyond which there is nothing to be gained by lessening the weight of an engine; but we think the performances of "The Novelty" furnish abundant proof that this engine, at least, has not approximated to that limit. The plan, besides, which the judges adopted, of requiring that each engine should draw *three times its own weight*, was calculated to prevent most effectually any delusion on this head.

The advantage gained by such a reduction in weight as "The Novelty" exhibits, is one of no small moment. On the Stockton and Darlington Rail-way, the enormous weight of the engines employed (12 tons, we believe,) has been a subject of great complaint. "The speed of the engines," says a writer on rail-roads, "has been increased on the Darlington road, by substituting wheels of 4 feet diameter instead of 3; but these working upon the plain bars cannot be case-hardened, for fear they should turn round when they have a hard pull; consequently, they are cast of soft iron, which, from the immense weight of the engines, *wears into grooves*, the width of the rails, and with the heavy drag, bites upon the rails, and twists them sideways, which keeps men incessantly upon the line setting them straight: the proof is obvious, because where the *engines* do not work, but the *wagons only*, the rails keep their position, and want no repairs."

The Directors of the Liverpool and Manchester Rail-way having the experience of these results before them, very wisely made superior lightness, one of the foremost qualifications, which should enable an engine to be ranked as "the most improved" of those competing for the prize. They announced that "the weight of the machine, with its complement of water in the boiler, must at most *not exceed six tons*, and that a machine of *less weight* will be preferred, if it drew after it a *proportionate weight*."

The means by which the inventors of "The Novelty" have been

able to combine so much lightness with great power, will be unfolded as we proceed with our description.

The prefixed engraving, No. 1, exhibits the external elevation of the engine. F is the carriage frame; E the end of a circular boiler which passes under the carriage frame towards the steam chamber A; L a hopper to receive the fuel, (which is carried in two small baskets placed on the frame,) whence it falls through a pipe in the centre of the steam chamber A, into the furnace S; M the ash pit; D and N two working cylinders and their slides, (one of each only is seen in the engraving;) B the water-tank; C an air-compressing apparatus, which acts on the furnace through the medium of a pipe that passes under the frame-work, and ends at K; N a pipe for the escape of the heated air; O G the connecting rods which impart the action of the pistons to the wheels.

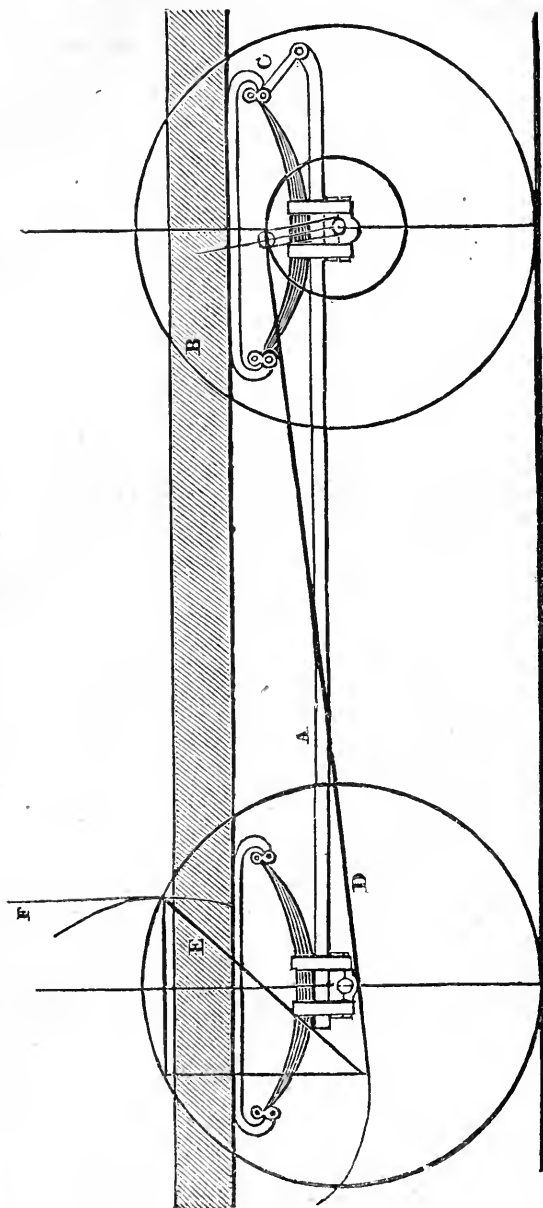
The boiler is made to contain about 45 gallons of water; the diameter of each of the cylinders is 6 inches, and the length of the stroke 12.

The engraving, No. 2, is intended to explain more particularly a very beautiful arrangement of the springs, to which this engine is mainly indebted for its superior steadiness when in action. The axletrees are fixed to the iron rod, A, and a sling, C, is introduced to obviate that side action which would otherwise take place between the rod and the carriage frame, B. Again, to prevent the action of the springs from interfering with the action of the engine, the connecting rod, D, is placed as nearly in a horizontal position as possible; the connecting rods are moved by bell cranks, E, which are connected by slings, F, with the piston rod.

The wheels are of the excellent description patented by Messrs. Jones and Co., and the choice of them by Messrs. Braithwaite and Ericsson, is as strong a tribute as could well have been paid to their merits. From the peculiar manner of their construction, they act with the least possible interference from the weight of the engine, and being perfectly cylindrical, bear equally with their whole breadth on the rails. The lightness for which these wheels are famed, is not in this instance so remarkable, "The Novelty" being itself in its main parts so light, as to throw other things in comparison with it into the shade. Of the total weight of 2 tons 15 cwt., we believe 18 cwt. falls to the share of the wheels.

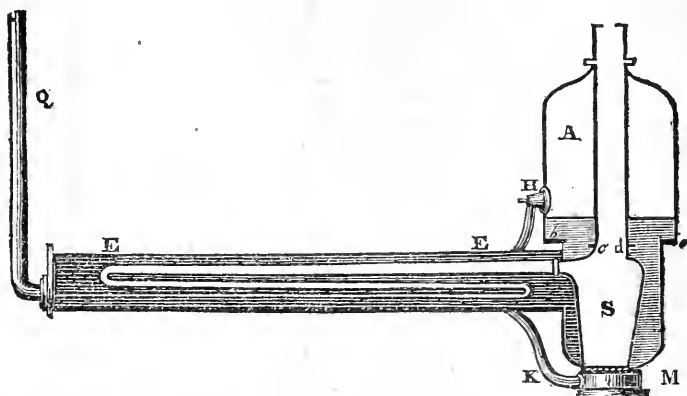
Having described the external appearance of this engine, we now proceed to explain its interior construction: for the better understanding of which, we present our readers with a rough, sectional view, (drawn from recollection) of the more material parts.

NOVELTY. No. 2.



S, is the furnace, which is supplied with fuel from the hopper, L,* (see the annexed engraving, No. 3,) through the vertical tube in the centre of the steam chamber, A; the heated air from this furnace passes off through a flue, which is made to wind twice or thrice up and down the cylinder, E, E, and gradually diminishes in diameter till its termination in the escape pipe, Q. The parts shaded in the sketch are those occupied by the water, which, it will be observed, surrounds the boiler as well as the flue.

NOVELTY. No. 3.



The extent of surface exposed to the action of the heat by this arrangement, is a great deal less than in other engines; and were the heat left to circulate as in other engines, through the agency of what is commonly called atmospheric draught merely, there would probably be nothing gained in respect of the quantity of steam generated. But instead of depending on the atmospheric draught, Messrs. Braithwaite and Ericsson make use of the bellows-sort of apparatus (CK) in No. 1, to force the heated air through the flue; and by thus supplying a greater quantity of caloric in a given time, they obtain an effect precisely analogous to what would result from doubling or quadrupling the size of the furnace and the extent of the flue. Nor is this all; the quantity of atmospheric air which is introduced under and through the fire by the pipe, K, has not only the effect of forcing the heated air onwards through the flue, but is itself a source of heat, equivalent to the employment of so much additional coke. It is in these two circumstances—the acceleration of the draft and the supply of fuel (if we may so speak,) derived from the atmosphere—that the great merit of “The Novelty”—the secret of its vast superiority—consists. It makes up, by the quickness of its operations, for the diminutiveness of its dimensions, by what it borrows from the air around it for the small supply of coke which it carries.

Neither does the rapidity with which the current of hot air passes through the flue constitute any exception to the efficiency of the process; for such is the aptitude of small circular pipes, like this, to

* Omitted in the engraving.

abstract heat from any fluid conveyed through them, and to part with it again to surrounding substances, that little, if any, caloric is suffered to pass unappropriated.

The flue is made to diminish *gradually*, because the heated air cools in its passage through it, and gradually requires less and less vent. It has also a downward inclination given to it, as represented in the sketch—such, that if a marble ball were dropped in at the furnace end, it would roll rapidly through all the convolutions of the pipe to the other extremity; and the object of so constructing it, is, that any dust which may arise from the furnace, may have always a descending passage to escape by.

In the specification of the patent which Messrs. Braithwaite and Ericsson have taken out for this mode of generating steam, mention is made of two air-forcing pipes: one by which atmospheric air is forced on to the *top* of the fuel in the furnace; and another through which the air is forced under the bottom of the fuel. A double supply of air, however, is only considered necessary where coal is the fuel employed, in order to insure its combustion more effectually; and where fuel of the purity of coke is made use of, as in "The Novelty," the upper pipe is dispensed with.

There are, of course, cocks to regulate the transmission of air through the pipe K; also safety-valves to the boiler and steam chamber; but these, as well as the feed pump for supplying the water from the tank, have been left out in our sketches, as being unnecessary to illustrate the principle of the engine.

It is now fitting we should explain more particularly, than has yet been done, the cause of those accidents by which some doubt has been for the moment thrown on the soundness of that principle. The engine, it appears, had been got up in a hurry—having been begun and finished within the short space of the six weeks immediately preceding the competition, and had never been subjected to any sort of proof. It was not to be expected, therefore, that it should be found perfect at all points. The part which was first observed to perform its office insufficiently, was the pipe of the feed pump; and the consequence was, that the water, which it is the business of this pump to keep always at the height marked in our sectional sketch, sunk below the level of the flue of the furnace; which flue being thus left exposed to a dry temperature of high elevation, gave way near to the flanch. In order to get at this damaged part of the flue, it was necessary to lift off the steam chamber, A, and for this purpose to undo the joints *b*, *c*, *d*, and *e*. To renovate the flue was an easy matter, but not so to restore the joints all at once to the state in which they previously were. The cement with which they were re-secured, would have required a week at least to harden properly; but it was as yet scarce twelve hours old when the engine started to perform the last task assigned to it. As might have been naturally expected, the joints yielded to the high temperature (300°) to which they were exposed; the steam began to escape at all points; and the efficiency of the engine was for the time and occasion, at an end.

The impartial reader will see nothing in any of these mischances tending in the least to discredit the principle on which "The Novelty" is constructed. It was not the peculiarity of that principle which caused either the defective feed pipe to go wrong, or the unduly exposed flue to crack, or the green joints to give way. The principle worked admirably, as long as every part of the machinery stood firm, and had fair play: nor can a doubt be reasonably entertained, that had the engine been previously proved (as cannon and muskets are proved,) and been kept in good working order, it would, upon the trial for a continuance, have fully realized the expectations which its previous performances had excited. The grand point on which its superiority depends, had already been fully established; namely, that it can generate a greater quantity of steam, in a given time, than was ever before produced by any apparatus of equal capacity. No further trial was wanted to show that what it could do for one hour in this respect, it would do for any number of hours. There might be errors committed in estimating the quantity of water and fuel requisite for a long journey; but there could be none in assuming that the power of the air-forcing pump to augment the heat, and accelerate the circulation of the heated air, must of necessity remain the same, whether the journey is short or long. Every thing needful for the manifestation of the master principle of the engine had been done; and all that was left unaccomplished, was but such a practical display as might convince those who, unable to appreciate principles, look only to results.

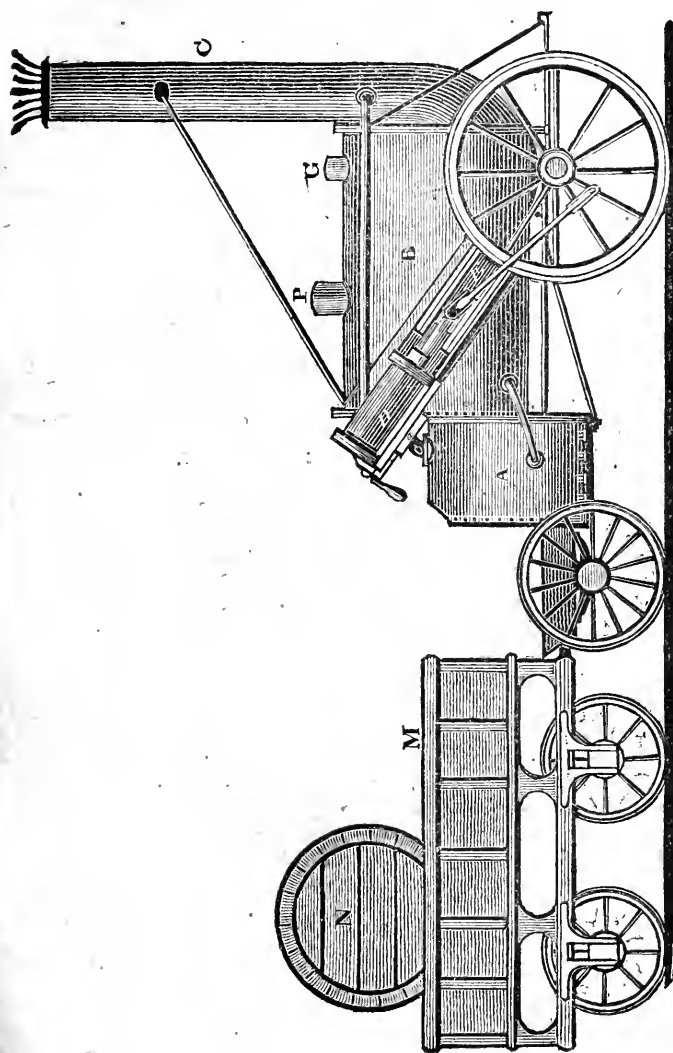
Second Engine.—The Rocket.

Annexed is an external elevation of this engine and its tender; but on a scale one-half less than our engraving of "The Novelty." The furnace, A, is two feet wide by three feet high; the boiler, B, is six feet long and three feet in diameter. The furnace, like that of "The Novelty," has an external casing, between which and the fire-plate there is a space of three inches filled with water, and communicating with the boiler. The heated air from the furnace is circulated through the boiler by means of twenty-five copper pipes of three inches each in diameter, which have their termination in the tall chimney, C. P and G are safety valves. The steam eduction pipes pass into the flue C. D, one of two steam cylinders which have an angular inclination towards the wheels, and embrace, like two arms, the boiler between them. E, one of the connecting rods which give motion to the wheels; a, the slide of the piston of the cylinder seen in the engraving; and o, one of the two escape pipes. M, is the part of the tender appropriated to the carriage of fuel; N the water cask.

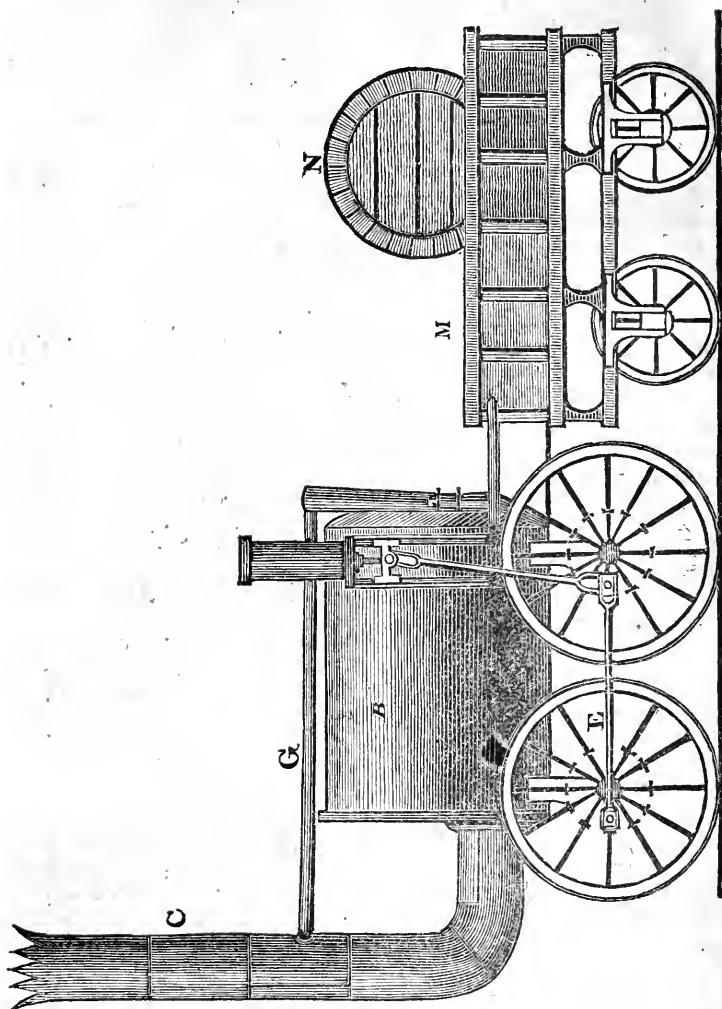
The performances of this engine indicate a very abundant and well sustained production of steam; but the extent of surface which it has been found necessary to expose to the heat, in order to obtain that effect, the great size of all the parts, and the quantity of fuel required, are faults which even a still more copious generation of steam would scarcely compensate. It is not by means of its heavy weight alone that such an engine would operate injuriously on the

rails. The chimney, from its great height—a height necessary to obtain that draught which in “The Novelty” is produced by means of the air-forcing apparatus, gives a swaying motion to the engine from side to side; and the rails have thus a lateral as well as a longitudinal force applied to jerk them out of their places.

THE ROCKET. BY MR. STEPHENSON.



THIRD ENGINE.—THE SANS PAREIL.

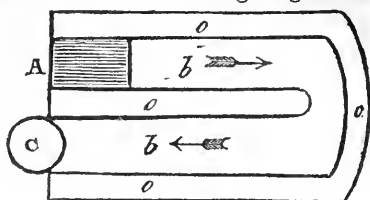


3. *The Sans Pareil.*—*Mr. Ackworth, of Darlington.*]

The preceding engraving presents an external view of this engine and its tender, on the same scale as the "Rocket," namely, a quarter of an inch to a foot. It exhibits in its general appearance, particularly in its large dimensions, a near resemblance to Mr. Stephenson's engine; but is much more compactly arranged, and on account of this compactness, travels with much greater steadiness. The furnace and boiler are not placed head-and-tail-wise, as in "The

Rocket," but form together the main body (B) of the engine, being constructed in the manner represented in the following diagram:—

A, is the furnace, *b, b*, the flue or tube through which the heated air passes in the direction marked by the arrows, to the chimney, C. The boiler, *o, o, o*, surrounds the furnace and flue. The working cylinder, the connecting rod, &c. are similar to those of "The Rocket," with the exception of being vertical instead of horizontal. The



waste steam passes into an external pipe, G, which has an ascending direction given to it towards the chimney, C; so that whatever portion of it is there condensed may fall back through the vertical branch pipe, at its lower extremity, into the feed pumps, (only one of which is represented in the drawing.)

The mode of generating the steam adopted in this engine, is the same which Trevethick introduced as far back as 1804, and possesses all the merit which has been generally conceded to that plan, without exhibiting any effort to obviate the objections that have been so generally made to it. The furnace and boiler are of simple construction, and of unquestionable efficiency; but their great size, and the large supply of fuel and water they require, render them but ill adapted to the purposes of a locomotive engine.

The comparative speed of the three engines, as verified by the recent experiments, stands as follows:—

	MILES PER HOUR.	
	With a load equivalent to three times the weight of the engine.	With a carriage and passengers.
The Sans Pareil,	12½	—
The Rocket,	12½	24
The Novelty,	20¾	32

[From the Baltimore Gazette of December 30, 1829.]

We have seen a letter from a most respectable house in Liverpool, under date of the 23d ult. to another in this city, which communicates the particulars of an experiment made on the preceding day, on the Liverpool rail-road, with wagons of burden, on the principle of our ingenious countryman, Mr. Winans' invention. The result is detailed in the following extract:—

"A trial was yesterday made of Mr. Winans' wagons upon the rail-road, drawn by 'The Novelty' steam engine, (Braithwaite and Ericsson's) which resulted as follows:—

Weight of engine,	3 tons.
" " load,	27 "
" " wagons,	5 "

Total 35 tons.

"This load was drawn 13 miles per hour.

“ At the same time Mr. Stephenson’s improved wagons were tried, and the result, at the same speed, was as follows:—

Weight of engine,	- - - - -	3 tons.
“ “ load,	- - - - -	16 “
“ “ wagons	- - - - -	7 “

Total 26 tons.

“ From this experiment, it appears, that as regards the load transported, the effect was as 16 to 27 tons, or about 68 per cent. in favour of Winans’ car.

The stock of the Liverpool and Manchester Rail-way is now £180 for £90 paid.”

[TO BE CONTINUED.]

On Colouring Gold Works Yellow, with some experiments on Gilding Bronze. By F. P. CASTELLANI.

[From the *Giorn. Arcadico*, 1826.]

EXPERIENCE has shown the author, that gold may be perfectly coloured, in a very short time, in a very simple manner, and with a uniform result, by certain liquids containing a solution of gold, and other saline and acid substances; owing to the chemical action, which, according to the opinion of the late Sir H. Davy, is exercised in the direct ratio of the electrical state of the substances exposed to it. It is then easy to perceive that this condition of the elements which compose the bath, contributes to oppose a too rapid electric action; and thus the precipitation of the gold is effected in a regular and perfect manner. Laying aside the task of exposing the theoretic ideas of the author, we shall proceed to make known his processes.

Of all the liquids proper for colouring gold, the two following appear to be the best.

First Mixture.

Hydrochloric (muriatic) acid at twenty-two degrees,	10 grains.
Sulphuric acid of commerce,	4
Crystallized boracic acid,	2
Pure water,	150

Second Mixture.

Acid hydrochlorate of liquid alumina,	13 grains.
Crystallized sulphate of soda,	4
Crystallized boracic acid,	3
Water,	150

Into either of these mixtures must be put twenty grains of a neutral solution of hydrochlorate of gold, in order to form excellent baths for giving to gold a yellow colour. The following is the manner of operating.

M. Castellani employs a furnace, somewhat like that used to roast

coffee; a circle of iron, with three feet to it, is enclosed in the sides of this furnace, upon which is placed a matráss having a very large mouth; and as its lower part is intended to come into contact with the fire, so it should be well defended with lute. All being thus disposed, we pour into the matráss the solution of gold, and when it has just attained the boiling point, we plunge into it the different pieces of gold work, by means of a wire of gold; these pieces of work must have previously been well cleansed, in the usual manner. At the end of some minutes after their immersion, we plunge in a copper wire, and which must remain until we perceive that the gold begins to assume a dark tint. We must then withdraw the copper wire, and leave the articles in the liquor, until they have acquired the yellow colour desired. We then plunge them into warm water, acidulated either by the sulphuric or acetic acid, in order to dissolve any particles of oxide of copper which may possibly adhere to them; they are lastly to be washed in warm water, and well dried, by placing them near to a charcoal fire.

Generally a single operation is not sufficient to produce the desired colour, and as a long continued immersion would be injurious, on account of the oxide of copper which is produced, so it is much better to repeat the process, until we have obtained the desired colour. In general, it is better to effect the colouring by many repetitions, in order to have it fine; as if the immersion be too long prolonged, the pieces become red, and must be cleansed anew, and submitted to new operations.

These mixtures are employed for those gold works which contain a fourth of their weight of copper; but it is probable, that the proportions of the principal constituents of these liquids may require altering, according to the quantity of copper in other alloys. And we may add, that the immersion of the pieces of gold work may be continued longer as they are more bulky or thicker; but the time must be shortened, when they are small, thin, or formed of wire, &c. When the bath which contains the gold in solution is no longer good, or begins to become weak, after many colourations, we may either add some drops of the solution of gold, or in case they may be required, some portions of the other constituents of the liquid. When the copper wire is found to be covered with a little metallic gold, it must be changed for another, in order that it may exert its electric action. If you would obtain an intense yellow colour, you must repeat the immersions, and the contact of the copper, many times; but if only a pale colour be required, it is sufficient, after the last immersion, to boil it, without touching it with the copper wire.

Bronze experienced the same effect as gold, after it had been coated with an amalgam of gold, and the mercury had been driven off by heating it. But the gold received a disagreeable and unequal yellowish white tint; the author blames the mixtures employed, in which there was much sulphate of copper, which, as M. Ribaucourt has observed, will never answer. He therefore proposed to adopt a mixture containing a salt of gold, nearly similar to the two preceding ones; and after some experiments which he has made, he is led

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to conclude that they will be attended with good results. But, as his experiments are not yet concluded, it is out of our power to describe his process, or to give recipes for the mixtures.

On transferring Prints to the surface of Wood, and either reversing them or not. And on making and applying hard White Spirit Varnish.

[From *Journ. de la Société du Bas. Rhin.* 1827.]

This process is very analogous to that formerly employed in transferring prints to the surface of glass, and to the back of which prints colours were afterwards applied, so as, in some degree, to imitate oil pictures. Here, however, they are applied upon the surface of wood, such as cornel, sycamore, horse chesnut, satin wood, *aer wood*, or the curly veined maple, &c., which is afterwards to be varnished.

The wood having been planed smooth and even, is to have a slight coat of the best glue applied upon it; when this has become dry, it must be rubbed with Dutch rushes, or glass paper, to remove the small filaments which the glue had raised, and render the surface uniform. We then apply a layer of white alcoholic varnish, taking care not to cross the marks left by the brush, and pass as few times as possible over the same place; it is then left to dry. We afterwards apply, in succession, three, four, five, or six, other coats of varnish upon it, according as the varnish may be thinner or thicker.

The edges of the print are then to be cut close to the engraving; and it must be laid upon a proper table, with the impression downwards; it must be then uniformly moistened with a wet sponge, or in any other manner. When it has been equally and thoroughly wetted, it must be placed between two leaves of blotting paper, in order to remove any drops of water. We then apply another coat of varnish over the surface of the wood; and, before it is become dry, apply the moistened print upon it, with the engraving downwards. In order to do this, we lay one edge of the print first upon the surface of the wood, holding it suspended by the other hand, and wipe successively over the back of the print, in such a manner as to drive out all the air, and prevent the formation of blisters. We then lay a sheet of dry paper upon it, and pass a linen cloth over every part of the print, in order to fix it securely upon the varnish. We must take great care to place the print steadily upon the varnished wood, lest we may make a false or distorted impression of it. We then leave it to dry; and when it has become thoroughly dry, we moisten the back of the paper with a sponge, and pass or lightly rub the fingers backwards and forwards over it repeatedly, so as to remove the moistened paper in small rolls curled up. When, however, the marks of the picture begin to appear, we must take care lest, in rubbing, we should remove any portion of the paper upon which the impression is taken. When we find, therefore, that we can remove

no more of the paper, without incurring the risk of injuring the print, we suffer it to dry; in drying, the engraving will entirely disappear at the back of the print, it remaining covered with a slight film of paper. But, on again giving one coat of varnish, it will be rendered entirely transparent. It must then be again suffered to become quite dry. If by chance we have raised any small parts of the engraving, we must retouch those defects with fine lamp-black and gum water, before we proceed to varnish, as we have before mentioned; great care must be used in laying on a second coat of varnish, passing rapidly over the retouched parts. When this last coat of varnish is become perfectly dry, we may remove any projecting part of the paper, and polish it with Dutch rushes, steeped for three or four days in olive oil; we then remove the oil by rubbing with a fine linen cloth, and sprinkle it all over with starch or hair powder; this will absorb the least remains of the oil, and we remove it by first passing the palm of the hand over it, and then by carefully wiping or rubbing it with a fine linen cloth; we next apply three or four more layers of varnish, taking care to let it dry between each coat. When the last coat is become quite dry (in three or four days' time,) we polish the varnish with a piece of fine woollen cloth, and chalk or whiting of the finest kind.

In order to prepare this fine chalk, we must grind the ordinary chalk in a mortar, with a little water; and when it is well ground, we add more water, and pour it into a glass vessel, suffering it to remain at rest five or six minutes, it will then have deposited its coarser particles. We then decant the liquid, which holds in suspension the finer particles of the chalk; let it rest, and when the water has become clear, we pour it off, and shall find the sediment in the form of a paste, and which we use to polish the varnish with. We must take care to use it in the moist or wet state; as, if it becomes dry, it is impossible to preserve it in the minutely divided state, and we should run the risk of polishing the varnish in streaks. If, however, we would have the varnish still more shining, we must wash off all the remains of this fine chalk with water, and polish it with the palm of the hand, only slightly moistened. But to have it still more brilliant, after having washed away all the chalk, and suffered it to become quite dry, we must pass all over it a thin coat of varnish, either in the sunshine, or near a warm stove, in order that the varnish may be extended uniformly upon the surface.

White Spirit of Wine Varnish.

Rectified spirit of wine,	- - - - -	24 ozs.
Fine sandarach,	- - - - -	4
Fine turpentine,	- - - - -	1
Spirit or oil of turpentine,	- - - - -	1
Camphor,	- - - - -	2 gros.

We must select the most transparent sandarach, and that which is the least yellow; but if it be not of the best possible kind, we must wash it in a weak lie of potash, and then in a large quantity of water, and let it dry perfectly. For the quantity above directed, we

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must take a bottle of white glass, well dried, and of the capacity of forty ounces; and, after pulverizing the sandarach, we reduce the particles of it to a kind of thin paste, by trituration it with some of the spirit of wine, and put it by degrees into the bottle. We likewise mix the turpentine and the oil of turpentine together, by rubbing them up in the same mortar; and when the turpentine becomes more liquid, we may increase its liquidity by adding some spirit of wine to it, and pour it into the bottle, when we must shake it for some time, in order to mix the materials well together. We likewise put the camphor into the mortar, and beat it up with some drops of spirit of wine; we then add a larger quantity of the spirit, which will entirely dissolve it; this is then to be poured into the bottle, and it must be again well shaken for some time, in order thoroughly to mix all the materials together. The bottle must then either be exposed to the heat of the sun, or that of a warm stove, for ten or twelve days, taking care to shake it from time to time; and to unstop it, in order to suffer the vapour to escape; but finally it must be close stopped, and the varnish kept for use.

On applying the Varnish to Wood.

We place the subjects, which we would varnish, either in the sunshine, or near a warm stove. We then apply six, eight, or ten coats of varnish. We must take care never to apply a second coat until the former one has become quite dry. If we would give the piece of work a fine lustre, we may polish the varnish, after the last coat is become quite dry, with finely washed chalk, applied whilst wet upon a soft woollen cloth. Or we moisten the palm of the hand, and rub the varnish with it, until it has acquired a perfect polish. Before applying the varnish upon wood, however, we must always prepare it by a coat of glue.

On fixing Prints upon Wood, in their natural position, and removing the Paper from them.

We select a surface of any kind of wood; the size of the print; we then moisten a piece of thick drawing paper, of a proper size, and apply upon its surface a layer of thin glue; we then suffer it to dry, and give it two or three more coats of the same glue, letting it dry between each coat; we then prepare the surface of this paper, to receive the print, in the same manner as the wood was prepared, as described in the first part of this article, by coating it with several layers of spirit varnish. We then apply the print, and conduct the operation exactly as before, to the period when we remove the last portions of oil by means of starch, and give several layers of varnish. The wood being then prepared to receive the print, by the coat of glue, and several layers of varnish, applied in the manner before described, we fix upon it the leaf of drawing-paper, bearing the print upon its prepared surface. We then apply a coat of varnish to the wood, and affix the prepared paper and print upon it, whilst it is still tacky; and so as to prevent the forming of any blisters or air-bubbles between them. When we think that the varnish is become hard, with

the help of warm water and a sponge, we moisten the glued paper which covers the whole; we then remove that paper, which readily comes off; and with the aid of the warm water and the sponge, we cause the glue to disappear from the varnished surface of the print; we then polish it with prepared chalk, and finish it; as before stated. This process may also be employed, not only to apply prints upon the surface of wood, but also upon metals, &c.

Chromate of Zinc as a Pigment.

M. Lampadius directs that chromate of zinc should be prepared by adding a solution of chromate of potash to one of sulphate or muriate of zinc. There is not at first any precipitation, but on adding more chromate, a deep yellow-coloured precipitate is formed. A yellow liquid remains, which being decomposed by solution of potash, also gives an abundant precipitate, but of a paler colour: these colours may be employed either in oil or with varnish.

[*Philosophical Magazine*, Jan. 1830.]

Green Lake prepared from Red Cabbage.

M. Lampadius states, when a hot infusion of red cabbage is treated with a solution of acetate, or still better, subacetate of lead, a very fine deep grass-green lake is obtained. Muriate of antimony, with a similar infusion, gives a rose-red precipitate. Infusion of cabbage may be employed to dye cotton and linen of these colours, after having used acetate of lead and muriate of antimony as a mordant.

[*Ibid.*]

Detection of Adulteration in Chromate of Potash.

M. Zuber states that this salt is frequently adulterated with muriate or sulphate of potash; and he proposes the following method of detecting them: Add a large excess of tartaric acid to the chromate of potash to be tried, the chromate will be decomposed, and acquire, in about ten minutes, a deep amethyst colour: It will now, if pure, form no precipitate with nitrate of barytes or silver, by which means the presence of muriate or sulphate of potash may be ascertained.

[*Annales de Chimie*, Sept. 1829.]

Improvement in the Smelting of Iron.

Heated air for blast furnaces has been used for some time at the Clyde Iron-works, and with great success. Experiments have proved that iron is smelted by heated air, with three-fourths of the quantity of coals required, when cold air—that is, air not artificially heated—is employed for that purpose; while the produce of the furnace in iron, is, at the same time, greatly increased. All the furnaces at

Clyde Iron-works are now blown with it. At these works, the air, before it is thrown into the blast furnaces, is heated 220° of Fahr. in cast-iron vessels placed on furnaces, similar to those of steam engine boilers. It is expected that a higher temperature than 220° will be productive of a proportionably increased effect. But this is the subject of experiment. It is supposed that this improvement will accomplish a saving in Great Britain, to the amount of at least £200,000 a year.

[*Edinburgh Philosophical Magazine.*]

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Query, respecting heating water by steam and the Solar ray.

DOCTOR JONES,—Sir, I take the liberty to hand you the following query, to which I will thank you to give a place in your valuable journal—and I shall be much gratified if some of your learned correspondents will furnish a solution; as I have examined the several Encyclopædias, and searched most of the scientific works that treat upon evaporation, caloric, steam, &c. without being able to discover any facts that will assist me in forming any satisfactory conclusions.

Yours,

ENQUIRER.

Query.—Suppose there to be two vats, whose surfaces are equal—for example—let them both be 60 feet long, by 15 feet wide, and 12 inches deep—each to receive the same quantity of water exactly, viz: 900 cubic feet; one of the said vats to be covered with an awning or roof, so as to exclude the sun's rays, but to be open on the sides and ends, and so high above the top of the vat as to admit of the free circulation of the air, and the ready escape of the vapour that may be thrown off during evaporation—the other vat to be open or uncovered, and to receive the full rays of the sun; but both vats to be so fitted with copper pipes, passing through the water in each, that steam may be directed at pleasure into either; thus arranged, suppose, on the 22nd day of June, (a clear day, having a dry atmosphere, and the dew point to be 59° deg. Fahr.) that the water in the uncovered vat is permitted to receive the full force and heat of the sun's rays, and that, at 1 o'clock, P. M. the water has acquired the temperature of 110° deg. of Fahr. In the other or covered vat, the steam is to be communicated to the water from a boiler, but in such *regulated* quantity, as only to raise the temperature to 120° deg. of Fahr. The water in the two vats being at that hour, at the respective temperatures of 110° deg. and 120° deg. Suppose the steam to be withdrawn from the covered or steam vat, and to be directed (in the same *regulated* quantity,) into the water which is in the open or sun's vat, and already heated to the temperature of 110° deg.—to what degree will the united heat of the sun and steam elevate the temperature of the water in the sun's vat? (allowing a sufficient time for the steam to communicate to the water the maximum of heat, which it was permitted to impart to the water in the steam vat;) or, in other words—what will be the united power of the two sources of heat, when directed into the water in the sun's vat? and by what *rule* can the same be demonstrated?

JOURNAL
OF THE
FRANKLIN INSTITUTE

OF THE
State of Pennsylvania;

DEVOTED TO THE
MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,
AND THE RECORDING OF
AMERICAN AND OTHER PATENTED INVENTIONS.

APRIL, 1830.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JANUARY, 1830.

With Remarks and Exemplifications, by the Editor.

1. For a method of *Ascertaining the Weight of the Cargoes of Boats, Ships, or Vessels*, called a "TONNAGE METER;" Eleazer Cady, Canaan, Columbia county, New York, Jan. 6.

A tube of iron, copper, or other metal, furnished with a stop cock, is to pass through the bottom of the vessel in any convenient situation; this is to be surmounted by a glass tube, standing vertically. When a ton of goods is put on board, the height to which the water rises in the tube is to be marked upon a scale, into which it is inserted, and so of a second, or any number of tons. This scale may be subdivided in the manner of other scales. A plumb line is to be suspended to ascertain the trim of the vessel.

"*Invention claimed.*—What I claim as my invention, is, the above described instrument for measuring the tonnage of a vessel, containing the glass tube and graduated scale. Also the plummet for determining the trim of the vessel."

Without adverting to other similar plans, we refer our readers to the notice of a patent taken out by Thomas Cohoon, of Troy, New York, dated June 18, 1829. This will be found at page 189 of our last volume. The mode of weighing goods in boats, there designated, is the same in principle as that above described; similar tubes are to be used, with one exception, they are to be wholly of metal, and the weight indicated by rods sustained by light floats.

2. For a method of *Warming and Ventilating Rooms*, by the burning of anthracite, or other coal, in what is denominated the "DORIC FIRE-PLACE, OR STOVE;" John Pierpont, Boston, Massachusetts, January 6.

The apparatus described by the patentee, is, "an open and portable fire-place, or stove, which may be made of a variety of different forms, but in every form must be constructed and arranged upon the principle of supplying to the room that is to be warmed and ventilated, in lieu of the air that through the smoke flue or chimney that passes out of it, and that by the operation of the fire itself, an equal quantity of fresh air from without the room, which, as it comes in, is warmed by being made to pass over, or between the heated surfaces of bodies that have not been brought into contact with a burning substance."

"The method of warming and ventilating rooms by means of any combination or arrangement of this principle, is what I claim as my invention."

"The doric fire-place may be made so as to stand either within the jambs of a common fire-place, or in a parlour, hall, or other large room in which there is no fire-place."

The name of "*Doric Fire-place*," is given to this apparatus from the doric columns which form a part of the ornaments of those which have hitherto been made.

The exterior of the stove, or grate, is in very good taste, and, but for the embargo which was instituted, and has been enforced, by the severity of the season, we should now have told the story of its actual operation, as the favourable judgment which we formed of it from the description and drawings, and our knowledge of the talents and truth of the inventor, induced us to give orders for one. Hereafter we will resume the subject, and give such a description of the apparatus, and such remarks upon its operation as observation and experience may justify.

3. For improvements in the machinery of mills for the *Manufacture of Grain into Flour or Meal*; Jesse C. Smith, Wheeling, Ohio county, Virginia, January 9.

What is claimed as new in the structure of mills, is the manner of framing and connecting the pressure rod with the bridge tree, and the using an elevating screw, in such a way "that the relative position of the faces of the stones is secured against any change by reason of an increased or diminished velocity of the runner," with certain other particular arrangements all tending to the same object.

4. For a *Machine for Washing Clothes*; William Arnold, Haddam, Middlesex county, Connecticut, January 11.

Very much like "a century of inventions" for the same purpose, and, no doubt, equally good with many of them, and destined to live to an equal age.

The claim is to "the arrangement and putting together the various parts."

5. For an improvement in the *Plough*; James H. Conklin, Peekskill, West Chester county, New York, January 13.

The mould board and share of this plough are both to be of cast iron; the share is separate from the mould board, and they are to be fastened together by sockets and pins in a manner described by the patentee; the distinguishing feature of the invention is the making the share in such a form that it is precisely alike on each of its edges and sides, so that when one edge and point are worn out, it may be turned and fastened as before, "thus causing it to last twice as long as the ordinary share, without any increase in its cost."

The claim is to the share, as described, and to the mode of fastening it on.

6. For an improvement in the *Plough*; Thomas Borden, Portsmouth, Newport county, Rhode Island, January 13.

"The description is as follows. The frame and beams of the plough is in a *triangular* form, with handles in the usual form; into the frame is fitted three shares composed of cast iron, wrought iron, or steel; the one in front, attached to the beam, is a *double* share, and on each side, attached to the frame, is a single share. By passing the plough between the rows of corn, &c. the earth will be turned each way towards the rows, which will greatly facilitate the operation, and save great part of the hoeing, in the common way."

"THOMAS BORDEN."

7. For a *Domestic Knife Sharpener*; Philip Cornell, Brutus, Cayuga county, New York, January 15.

It seems by the description that two blades are to be set into a handle, in such a way that by means of a screw, they may be made to form any desired angle with each other. The knife to be sharpened is to be drawn between these.

Several instruments similar in principle, have been previously described by us. There is no claim made by the patentee. A model of the instrument has been deposited in the patent office, but no drawing has been furnished. If the patent law means any thing where it makes an absolute demand of a drawing with references, "*wherever the nature of the case admits of drawings*," the present patent must be entirely invalid. If a *machine* can be described, and a *model* can be made, it certainly *admits of drawings*.

8. For an improvement in the *Plough*; A. D. Armstrong, Springfield, Clarke county, Ohio, January 15.

In the specification and drawings which accompany this patent, a particular description is given of the manner of forming and connecting together the various parts of this plough. They consist,

principally, in minute points of form, and modes of connexion. The claim is also to a great number of minute particulars, as "the additional depth of the bar; the greater drop of the share; the position of the line at the forward edge of the mould board; giving the shape, or wind, whereby the face of the plough can be swept clean by the motion of the sod, or straight edge, when using the plough; the angle which the forward edge of the share makes with the bar, and the proportions, generally, of the mould board."

The foregoing is but a short sample of the claims, many of which are, from their nature, indefinite, and others, certainly not new.

9. For an improved machine for *Shelling Clover Seed*; Jacob Gorgas, Frederickburg, Lebanon county, Pennsylvania, January 15.

There are two circular metallic plates $2\frac{1}{2}$ feet in diameter, which are punched so as to form graters, or rubbers, such as have frequently been used for cleaning grain, they are fixed upon wood, and stand vertically in a frame; one of them is stationary, and the other made to revolve by means of a crank; an opening is made through the stationary rubber, to admit the seed to pass from a hopper, so as to be subjected to the rubbing process; it passes out around the edges, where pieces of leather are placed which are to complete the operation.

The claim is "the construction of the above described machine, with the use of the circular metallic rubbers, and the leathers."

10. For an improvement in *Pounding, Grinding, and Separating Gold from the Earth, Stone, or Rock*; Samuel Whisler, of Rockingham county, and James Smith, of Spottsylvania county, Virginia, January 15.

The first operation prescribed is to put the ore into a trough, to subject it to the action of stampers.

The second is to grind it by placing it in a circular trough, where stones, like those used in the old bark and drug mills, roll over it.

The gold is then to be separated by washing in an iron, or other trough, amalgamated by mercury, then "put into a still, the quicksilver evaporated and the gold collected."

"*The invention claimed.*—What we claim as our invention, is, the above described machine, for pounding and grinding metallic ores."

It would seem incredible, but for the repeated evidences of the fact, that men should throw away their money to obtain patents for what is not merely old, but perfectly common. There is not in the foregoing even the semblance of novelty, either in the machinery, or the mode of operation; in our estimation, the patent is just as good and no better than one would be for grinding grain between mill stones.

11. For an improvement in the manner of *Spreading Blister*

Plaster, commonly called Blister Cloth; Elisha Perkins, Physician, Baltimore, Maryland, January 15.

The plaster is to be spread on the cloth by means of iron rollers like those of a flattening mill, and turned in the same way. The rollers may be about 22 inches in length, and five inches in diameter; the upper roller before using it, is to be taken out and heated in boiling water; when replaced, the cloth is to be passed between the rollers. A roll of the composition to be spread is placed upon the cloth, in contact with the heated roller, and, by turning, spread thereon. The plaster is to be without any of the fly in its composition, as this is to be dusted upon the surface after it is spread, and affixed by folding the cloth and again passing it through the rollers when cold.

There is some ambiguity in the specification, which renders it uncertain what was intended to be patented; the patentee tells what he does not claim, but has not informed us what he does, excepting in the following declaration, that "this improvement consists in the spreading of the plaster by means of two cylindrical rollers of cast iron, brass, or other hard metal, and in spreading the fly altogether upon the surface of the plaster." The mode of effecting the spreading is by rollers, which rollers are described, but unaccompanied by any drawing; the patent, therefore, if for the machinery, we should deem invalid. The second item, that of spreading the plaster without the admixture of the fly, has no claim to novelty, we have done it hundreds of times, and, in fact, it was the uniform practice of the gentleman from whom our first medicinal instructions were received, and, we believe, that it is still frequently done.

12. For a *Machine for Excavating Earth under Water*, called a "FLOATING EXCAVATOR;" Alanson Watson, Pendleton, Niagara county, New York, January 18.

A scow, or boat, is to have an opening through its centre, of about 4 feet in width, and 14 in length. A flat piece, called a scraper, is to be let down, horizontally, through this opening; the fore end of the scraper is to be supplied with two plough-shares, one at each corner: the scraper is to be lowered, and raised when loaded, by means of two racks and pinions, and a rope and windlass. When the scraper is to operate, the boat is to be drawn forward by means of a rope attached at one end to an anchor, or other fixed object, and at the other to a windlass in the boat.

"*Invention claimed.*—What I claim as my invention, is, the before described machine, with the use of the plough-shares, racks, and pinions, and cylinder [wheel and axle] for raising and lowering the scraper."

13. For an improvement in the art of *Catching Ducks, Geese, Swans, and other Fowl*; William Coffield, Norfolk, Norfolk county, Virginia, January 18.

A net is to be made of small and strong twine, with meshes of five or six inches square; it is to be as large as can be conveniently managed. This net is to be spread over the water, whilst the ducks, &c. are below, feeding on the roots of aquatic plants; on rising, they will be caught by the neck in the meshes.

"Secondly, the same kind of net, and to any size, may be placed horizontally, near the bottom, where the ducks feed, which will catch them by their necks, as they dive for their food."

The net may also "be set perpendicularly, and be drawn over the ducks, by means of lines, whilst feeding at the bottom, thereby catching them by their necks as they ascend."

A net is sometimes to be fixed permanently by one edge, either on water or on land, and is to be cast dexterously "over ducks, geese, swans, or any other fowls, by means of strong wooden or steel springs, which are to be managed by means of lines leading to the shore, or elsewhere, as may be most convenient."

We leave all judgment upon the foregoing to those who are in the habit of handling nets, and catching ducks, geese, and swans, as the information given affords but little light to the uninitiated. With respect to the last plan proposed, as we apprehend that the "strong wooden or steel springs" must have something peculiar in their structure and arrangement, we should have been glad of some further description, and a *drawing*, as guides to their formation and use; but the patentee has left us in the dark in this important particular.

14. For an *Improved Tiller Wheel*, for steering vessels; Cornelius Tiers and Joseph Myers, Philadelphia, Pennsylvania, January 18.

The specification, with engravings, shall hereafter be given.

15. For an improvement in the *Machinery for Sawing Boards, Timber, &c.*; David Flagg, jr., Gardiner, Kennebeck county, Maine, January 19.

Two circular saws are to be made, one of which is to run immediately under the other, with their peripheries as near as may be, without touching. The object is to saw on the two sides of a log, as "by these means timber may be cut of a size nearly equal to the half [whole?] diameter of each saw."

The claim is to "the application of two saws acting together, as above described."

By turning to page 259, vol. 4, first series, an account of similar machinery will be seen, with an accompanying drawing. It was the subject of a patent granted in England, to George Sayner and John Greenwood, for improved sawing machinery. In one point, at least, the apparatus there described is better than that above noticed; two circular saws are used, one above, and the other below the log, but they are placed a little in advance of each other, so that each may cut a little beyond the centre of the log; in other respects they act as in the machine claimed by Mr. Flagg.

16. For *Hewing, Picking, and Drilling Stone* by machinery; Linus Yale, Salisbury, Herkimer county, New York, Jan. 20.

There is a lever, or levers, with steel picks, chisels, or hammers, at one end. The lever works on a pivot, at, or near, its middle, the end opposite to the chisels being operated upon by a wheel, with cams, or lifters, like a tilt hammer, so as to make the lever vibrate and the chisels cut. A wooden, or other spring, bears upon the lever so as to keep it in its proper position.

The stone is to be placed upon any convenient kind of carriage, that it may be moved about to be operated upon by the chisels, &c.

"The main object of the petitioner, is, to prohibit all persons, without his consent, until the patent expires, from hewing, picking, or drilling of stone, by means of steel picks, chisel, or hammer, attached to any lever, or levers, handle, or handles, sustained as aforesaid by springs made of wood, wire, or steel, and propelled by a shaft set in motion by hand, horse, water, or steam power."

We fear that Mr. Yale will not accomplish his "main object," as there are a number of American and European patents for applying chisels, &c. for cutting and picking stone, both flat and in the form of mouldings, in which levers, or handles, are certainly used in a way which, we apprehend, will interfere with this *subsequent* claim.

17. For a machine for *Thrashing Wheat, Rye, Oats, and Barley*; James Clark and Isaac Starks, Geneva, Cayuga county, New York, January 20.

The feeding rollers, apron, beaters, hollow segment, or shell, as it is here called, so perfectly resemble many other thrashing machines, as to render it impossible for us to touch a single point of novelty in it.

What is claimed "is the yielding bed, shell, or floor," "and the stationary beaters on the main cylinder."

18. For *Improvements in Locks*; George A. Rogers, Augusta, Kennebeck county, Maine, January 20.

The bolt of this lock is to be operated upon by toothed wheels, and an endless screw; the key is like that of a clock; there are certain checks, pinions and racks, which could not be described without drawings, and, from a cursory inspection, it does not appear to us to possess any peculiar claim to notice. The whole apparatus is described, and no claim made to any particular part.

19. For a machine for *Thrashing Clover, Herd Grass, Rice, Wheat*, and other small grain; Henry C. Atwood, Litchfield, Connecticut, January 23.

Beaters on a cylinder, working in a hollow segment, and the other *et cæteras* which usually constitute a thrashing machine, are here again assembled. The segment is to be composed in part of squared

or fluted rollers, and in part of triangular pieces; the boxes of the cylinder are to have play, to let the cylinder give back in case of a stone. Some minute directions are given as to the form of the beaters, and upon them, if upon any thing, the novelty depends. The patentee says, "what I especially claim as my invention is the oval or triangular bars placed in the concave; the relief beaters on the cylinder, and the fluted rollers at the bottom of the concave, which conduct the straw when thrashed, clear of the grain."

20. For an improvement in the apparatus and process to be employed for *Purifying, Refining, and Settling the Salt Water of the Ocean, and the Brine of Natural Salt Springs*, for the manufacture of muriate of soda, or common salt, by artificial heat; Seth Hunt, now of the state of New York, January 23.

The preceding patent is taken, principally, for the application of heat to the brine while in the settling vats, cisterns, or reservoirs, for the purpose of throwing down and separating therefrom the sulphate of lime, and other earthy impurities with which it is impregnated.

The specification is of considerable length, and appears to be worthy of a more particular notice than we can here give it; we shall, therefore, take it up again, and make such an abstract as will place its merits before the public.

21. For a new method of *Propelling Vessels in or through the Water*; Benjamin Phillips, Shipwright, Philadelphia, Pennsylvania, January 23.

The method proposed consists of "a newly constructed case or cylinder, with valves in it for propelling vessels in or through the water," to be used instead of paddle wheels. A patent was taken out by the same gentleman for a similar purpose, of which we gave an account in the 2nd volume of the new series, p. 256. We apprehend that his former plan has been abandoned, and the fate of the new scheme, we have little doubt, will correspond with that of its predecessor. The new proposition is to have hollow cases, open at both ends, which cases are to slide from stem to stern of the vessel, at each of its sides, there being a steam engine, or other power, to move them. Valves, closing like shutters, which are to be hung by their upper edges, are to open as the case retreats, and close when it moves in the reverse direction. It is proposed sometimes to suspend these boxes in the manner of pendulums, which, in vibrating one way, will open, and in the other close the valves. The patentee compares these valves, in their action, to the opening and closing of venetian blinds.

The claims are to "the cases, the manner of fixing the valves within the case, the manner of connecting them to the steam engine, applying the power alternately, as one case slides aft, or propels the boat, the other case is sliding forward, its valves open, and on

the return its valves shut down, and the other valves open. The cases may be either *copper, iron, wood, or metal.*" "I claim being the inventor of this principle of propelling, or pumping vessels through the water, without causing any waves, or sea, or ruffling its surface."

We do not think it necessary to reason upon the subject of the total inadequacy of the foregoing to effect the object proposed, excepting to such as are altogether uninformed respecting it, and to these we have not time to attend.

22. For an improvement in the mode of *Evaporating Fluids, and Drying Cloths, Wool, Silk, Paper, &c.* without assistance from heat; Joseph Hurd, jr., Boston, Massachusetts, January 23.

The specification commences by stating that the "improvement consists in giving motion to the objects from which water, or moisture, is to be expelled."

A large revolving frame is to be made, in form something like a reel; upon this the cloth, or other article to be dried is extended, and fixed by tenter hooks, or otherwise.

"The shaft is to be put in motion by water or other power. The evaporation will increase in proportion to the velocity of the motion. When the motion is very rapid, the effect is not merely evaporation, but water is sensibly thrown out of the cloth by centrifugal force."

"It may be used with great effect for evaporating salt water for the purpose of making salt. The water may be thrown into a basin on the top of the shaft, having holes in its bottom, through which the water might pass and trickle down ropes, boards, coarse cloths, or any thing more suitable, which should be suspended and connected with the upper and lower parts of the shaft."

This apparatus is certainly well calculated to promote evaporation, and will, we think, be found applicable to many useful purposes.

23. For an improved mode of *Taking the Figures of Ingrain Carpets from the Cloth*; William Sherwood, Somersworth, Strafford county, New Hampshire, January 26.

The plan proposed appears to be simple and ingenious, but the accompanying drawings are not sufficiently descriptive. The points claimed, are, "*First*, the raising of the figure by a combination of levers, independent of hooks and knot cords. *Second*, the application of a machine to change the shuttles, by accelerating the motion of the boxes, so as to make either of the treadles which work the figure, raise them different heights at different times, the motion of the treadle being always the same. *Third*, the method of using four shuttles. *Fourth*, the raising all the shuttle boxes between the upper and lower ones, by rests which cannot raise them any higher than to throw the shuttle required. *Fifth*, the placing the cloth beam back of the harness, and bending the cloth from the breast beam to it. *Sixth*, two methods of regulating the tension of the weft, as described."

24. For a *Lock for Securing Doors, Trunks, Chests, &c.*; Asa Beals, Exeter, Rockingham county, New Hampshire, January 26.

This is a combination lock, to be set by indexes, in a manner well known to those who are curious on such subjects. The patentee describes his lock, but does not claim any thing appertaining to it. We do not know, therefore, what part he esteems to be new.

25. For an improvement in the *Boxes, or Hubs of Wheels for Carriages*, also in ship blocks, and boxes for machinery; Isaac Cooper, Baltimore, Maryland, January 27.

The axle is to be surrounded by friction rollers, contained within the hub, or nave, of the wheel, or within the boxes of machinery. This, as we have repeatedly remarked, was effected about fifty years ago, by Mr. Garnett, of England, and patented by him. There is but little difference between his mode, and that described by the present patentee, and we are fully convinced that the latter is not by any means an improvement upon the former. The hub proposed to be used is to be of cast-iron; there does not appear to be any thing in it, particularly worthy of notice, or materially different from such as have been previously patented.

26. For a *Tread Wheel Rail-way*; Benjamin Sutton, Romulus, Seneca county, New York, January 27.

This "Tread Wheel Rail-way is intended to be used for the purpose of raising and elevating earth, stone, and other weighty substances out of canals, or other excavations, or for raising embankments for any purpose, and is particularly applicable to the propelling or elevating of cars and carriages upon the ordinary, or common inclined rail-way now in use."

The specification states the following to be the claim of the patentee.

"The improvement (the invention whereof I claim) is the tread wheel, by which the entire weight of one or more men is made to act with ease and convenience upon the car, weight, or burthen to be raised, or drawn up."

"The machine may also be applied with advantage to the elevating or lowering of burthens in a perpendicular direction, by placing the rope, strap, or chain, over a pulley directly above the burthen to be raised."

The size of the drum, or tread wheel, we are told, may be from six inches to twenty feet in diameter, according to the weight to be raised.

This patent tread mill, or wheel, is precisely like other tread mills, which may answer very well to keep culprits employed, but the power of a man thus applied, has not been found to be very nearly related to *ease and convenience*.

Tread wheels for cranes, and for raising water from wells, have

been in use time out of mind. Men and other animals have generally, however, been employed to turn them, by walking within a hollow drum, in preference to using steps on the outside.

27. For a machine for *Forming or Constructing Hat Bodies*; A. H. Stevens, Richland, Oswego county, New York, Jan. 27.

The specification states that this is an improvement upon the machine for forming hat bodies, invented by H. F. West and A. H. Stevens.

The wool is to be delivered from a carding machine in a continued sheet, and is to be received upon an endless apron, revolving on rollers with the proper speed; the hat former resembles two cones, joined at their bases; it is improperly called a cylinder in the specification. This former is to be made hollow, that it may be light, is to be covered with cloth, that it may take hold of the wool, and is to be rolled over the fleece by hand, being tilted from side to side, as, from its form, it rolls towards either edge, and this diagonal rolling causes the fibres to cross in the manner requisite for forming the body. The claim is to "the round cylinder" [double cone] "or splint hat former; and substituting it for the board, or flat hat former, of West and Stevens."

28. For a *Churn*, called the "Cradle Churn;" John Barber, Carolina, Tompkins county, New York, January 28.

A box is placed upon rockers; this box is divided into two compartments by upright slats, having spaces between them; as the churn is rocked, by means of a lever, or rod, the cream passes between these slats, and is of course agitated, so as, in due time, to produce butter.

There is no particular part claimed; we conclude, therefore, that the patentee considers the whole as new.

29. For a *Machine for Thrashing Grain*, and hulling clover seed; Chester Clark, Colebrookdale, Berks county, Pennsylvania, January 28.

The beaters which surround the cylinder in this machine, or which rather form part of the skeleton of a cylinder, are to have their surfaces cut somewhat in the form of a coarse screw, and instead of being placed parallel with the axis of the cylinder, stand diagonally, so that one end of the beater shall come in contact with the grain, whilst its other end is at a distance, a second entering in the same way, before that preceding it has ceased to act. The mode of feeding; the concave segment; springs, &c. resemble most of the other thrashing machines. The claim is to "the screw formed beaters, and the general construction of the above described machine."

The screw formed beaters may be new; the general construction seems to be a claim not very securely founded.

30. For an improvement in the art of *Cleaning Rice from the Hull, Husks, or Coats*; John Ravenel, Charleston, South Carolina, January 29.

Mr. Ravenel formerly obtained a patent for improvements in the mill for cleaning rice, of which we gave an account in vol. 4, p. 49.

The improvements now claimed, are the making the cranks, which work the pestles, so short, that they shall never be lifted above the surface of the grain in the mortar; thus producing economy in time, and in the expenditure of power. The cranks situated upon the same shaft, for working rows of pestles, are distributed around it, so as to form radii of equal angles with each other, by which means the power is equalized, no two pestles having the same action at the same time.

31. For constructing *Patterns of Metal, Wood, or other Material, to be used as Moulds for Casting*; Jonathan Leonard, jr., of Meriden, Jareel, S. Brainard, and Amasa Sizer, of Wallingford, New Haven county, Connecticut, January 28.

The invention claimed to have been made by the patentees, is, "a new and useful mode of constructing patterns formed of metal, wood, or other suitable material, and consisting of a plate with raised work, or projecting figures on each side thereof, to be used in making moulds, the parts of which are in different parts of a flask, and which moulds are fitted for casting work in iron, or other metal. But we do not claim the exclusive right of making patterns for moulding, or any mode of using them which has heretofore been practised."

It has been a common practice in moulding spikes for ships, and many other articles which are to be cast in great numbers, to fix one-half of the patterns on one mould board, and the corresponding halves upon another, so as to mould upon the principle above pointed out. Metal plates with one-half the pattern on each side have also been used, and a patent obtained for them. A particular account of this will be found in our list of patents for March, 1829, at page 419 of vol. 3, new series.

32. For an improvement in *Taps and Dies*; Archibald Lamont, Pittsburgh, Allegheny county, Pennsylvania, January 29.

The peculiarity in the taps consist, principally, in the body, or solid part of the tap, within the thread, being perfectly cylindrical, whilst the whole form would be conical, were the spaces between the threads filled up. At the point of the tap the thread commences at nothing, as it is technically termed, whilst at the upper part the thread is of the full depth required. The diameter at the top, therefore, exceeds that at the bottom by double the depth of the thread. Two flutes are made on opposite sides of the tap, in order to form the cutting edges, and to allow of space to receive the cuttings.

This appears to us to be a good form for a tap, especially for a square threaded screw, such as is represented in the drawing ac-

companying the patent; it, however, is spoken of as applicable to such as are rounded or mitred; but the formation of these certainly would be attended with much greater difficulty.

"Of the dies. The cavity of the dies by which the screw is made forms an entire and complete circle, having two circular openings across the centre of the dies, which form the cutters and also prevent the passing off of the chip. The screw in the dies also commences at nothing, or a plain surface, and gradually increases until the thread acquires the full size."

According to the drawings, the "two circular openings" are two flutes on each die, filed along side of the screw, to form a cutting edge.

These dies do not appear to us to promise so fairly as the taps; if a thread could be cut the whole depth at once, they would act well, but this, generally, is out of the question; only one cutting thread can be in action at once, and that the most prominent. A complete circle, offers no small practical difficulty in cutting deep threads with dies.

33. For an improved *Thrashing Machine*; Edward Warren, City of New York, January 29.

In this machine, instead of beaters along a cylinder, rows of iron teeth, about an inch square, and about the same distance apart, extend from end to end, the rows being about four inches from each other. The spaces in one row are opposite to the spurs, or teeth of the next. The concave segment, and other parts are pretty much like a host of others.

"What is claimed by this improvement, is, the spurs acting upon the grain over the concave bars."

34. For a mode of *Manufacturing Axes by Machinery*, called the "Oval Axe Machine;" Stephen Hyde, Williamsburgh, Hampshire county, Massachusetts, January 29.

The patent for the object above stated, is obtained for giving to the hammer and dies, which may be attached to the common trip hammer, such shapes as shall give to the iron the form which prepares it for receiving the steel, and forming the eye, so that by the use of this improvement but one person is required in making axes.

35. For a *Thrashing Machine*; Joel Dewey, jun., Troy, Rensselaer county, New York, January 29.

If our readers are not ready to make a truce with thrashing machines, we are; the only comfort attending their consideration in the present month, is, that they appear to have excluded the washing machines from the contest.

In this machine, upon what would otherwise be *beaters*, wires are fixed in rows, and form *pickers*. The grain is fed to these pickers by fluted rollers. Instead of being carried down, the grain is carried

up, the segment which encloses it being placed above. The inventor says—

“What I claim as new and my own discovery, in the above described machine, and for which I ask an exclusive privilege, is, the manner of feeding, and its operation on the grain being backwards, which thrashes the loose heads; and its *being new in almost all its parts.*”

36. For a *Churn*; John Ewing, Westboro, Worcester county, Massachusetts, January 29.

This is very much like the common barrel churn with four dashers, but instead of a barrel, an oblong-box contains the cream and the dashers. Upon the shaft is a cog wheel of 10 inches diameter, which is to be acted upon by one of 5 inches diameter, there is also a fly wheel on the shaft.

We are told that “this new invented churn stands upon its own bottom,” which is well enough; but as there is no claim, we are not informed if it is in this that the invention consists.

37. For machinery for *Washing Gold out of Gravel and Sand*; Peter Summey, Lincoln county, North Carolina, January 30.

The machinery here patented is but very imperfectly described, and does not appear to present any principle, or arrangement, upon which to found an exclusive right. The earth to be washed is put into a vertical cylinder, in which it is agitated, by means of a revolving shaft, and the gold, and other heavy particles take the lowest station. From this cylinder the washings pass through a conductor, into a rocking trough, where the separation is to be more perfectly made.

There is no claim to any part.

38. For making *Tow Lines for Towing Boats*; Aaron Bull, Carlisle, Tompkins county, New York, January 30.

Brass, copper, or iron wire, is to be laid between the strands of an ordinary tow line, “on the surface, so as to give strength and consistency to the line, and prevent as much as possible all friction and wear.”

The claim is to the doing this:

We apprehend that these patent tow lines will not come into general use. The wire will be liable to break, will add to the weight, and thus increase the friction of the line, whilst it will be difficult so to place it as to form the prominent surface of the line.

39. For an improvement on the *Tongue Plane*, used on the edges of flooring and other boards; Emanuel W. Carpenter, Lancaster, Lancaster county, Pennsylvania, January 30.

The tongue plane described in the specification, has two separate

irons and wedges, instead of the notched iron generally used; sometimes the irons are to be connected together by means of plates and screws at their upper ends; in either case the object is to regulate their distance from each other, so that the tongue and groove shall always fit.

The same thing was patented more than a year ago, by Messrs. Longnecker and Myers, of Lancaster, as may be seen by turning to p. 336, vol. 3, new series.

There is not any claim made.

40. For a *Tackle, Windlass, and Lever Press*; John B. Carpenter, Henderson, Jefferson county, New York, January 30.

The claim to novelty in this press, is, "the application of the windlass, tackle, and lever, to the machinery for pressing."

It consists of a windlass standing across the press from one cheek to the other; this is to be turned by a handspike, there being a ratchet wheel and catch to prevent it from turning back. A rope from each end of the windlass passes round sheeves in the sliding frame. There are three represented in the drawing, but a greater number, it is stated, may be used; this windlass, with its tackles, operates upon the follower of the press, and draws it up, or down, according to the arrangement made.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for certain improvements in the construction of Wooden or Frame Bridges. Granted to S. H. LONG, Bt. Lt. Col. of the United States Engineers, March 6, 1830.

THE objects aimed at in this invention, are greater simplicity and economy in the construction of bridges, together with greater strength and efficiency than have hitherto been attained from any combination of principles, or arrangement of parts heretofore adopted in structures of this description.

The improvements under consideration, by means of which the objects above mentioned are to be accomplished, consist of the following modifications or arrangements, in the construction of the main longitudinal truss frames necessary to the formation and support of a bridge, viz.

1st. Two modes of splicing the string pieces, one of which is effected by means of wooden, and the other by means of iron splicing pieces of a construction different from any heretofore adopted in bridge architecture.

2nd. A system of bracing, by means of which the truss frames are exempted from leverage in every part liable to be affected by such an action, and the stresses or thrusts communicated by the braces, are resisted by shoulders or steps as nearly as may be at right angles with the grain, or fibres of the timber.

3d. A system of counterbalancing, by means of which the truss frames are rendered stiff and unyielding, and the bridge kept in uniform action, whether loaded or unloaded.

4th. A mode of furnishing the main braces and posts with metallic bearings, by the introduction of thin plates of iron, copper, or other suitable metal, between the *heel* and *toe* of each main brace, and the steps in the post against which they thrust, and

5th. A mode of keying, or wedging, by means of which the central parts of the truss frames, and consequently of the bridge, may be elevated, and sustained, in case of a subsidence or sinking of those parts, which is liable to happen from a shrinking and extraordinary compression of the timber.

These several improvements which are claimed as new, useful, and original, together with a variety of other arrangements, many of which are believed to be unprecedented in bridge architecture, will be more clearly illustrated by the drawings and explanatory references hereto annexed, and exhibited under the designation of the "JACKSON BRIDGE."

EXPLANATIONS AND REFERENCES TO THE DRAWINGS.

Plate III.

Fig. 1. A side view of a truss frame exhibiting the systems of bracing adverted to in articles 2nd and 3d of the preceding specification.

A, B, the upper string showing the position of its splices, and the insertions of the posts, &c.

C, D, the lower string with its splices, &c. *Note.* Inasmuch as the upper string acts by thrust, and the lower by tension, the splices of the latter only require particular care and precision in their adjustment.

E and F, inferior arch braces, supported on the lower sill of the abutments, and inserted in the lower string immediately behind the 2nd and 3d posts from each extremity of the truss frame. G, superior arch braces connected with the centre post prolonged above the frame, and inserted in the upper string, at the head of the 2nd post from the centre.

a, the posts; *b*, the main braces, *c*, the counter braces.

Note. This figure is also intended to indicate the manner of constructing the Carrolton viaduct, which differs from the bridge only in its adaptation to the purposes of a rail-road, in which application the floor timbers must be more frequent in order to afford an unyielding support to the rails, and the arrangements in other respects must be such as to admit the free and safe passage of a locomotive steam engine. *m*, the positions of clamp bearers or floor timbers, attached to the posts by means of screw bolts.

n, the positions of intermediate floor timbers resting upon the main and counter braces at their junction and intersection, upper and lower.

Note. The relative distances between the strings and any two

adjacent posts longitudinally of the truss frame, should be about in the proportion of $1\frac{1}{2}$ to 1.

Fig. 2. A horizontal view of a bridge with single road-way and double truss frames.

Note. The right half of this figure, viz. BC, GH, presents a view of the lower strings, floor timbers, &c., and the left, viz. ABCD, a view of the upper strings, bearers, lateral braces, &c.

E, F, a streamer, midway of the bridge, affording the means of connecting the lateral braces, with the bearers.

a, the beams, b, the lateral braces, c, the splices of the upper and lower strings, d, the splices of the interior string piece of the lower strings, e, the floor timbers, f, lateral braces connected with the floor timbers, g, a short streamer affording the means of connecting the braces, e, with the floor timbers.

Plate IV.

Fig. 3. An end view of the timbers, &c. of the bridge. AB stay braces of iron, for maintaining the vertical position of the truss frames. C the upper and D the lower sill of the abutment. E the transverse braces. F the posts. a, the beams, and e, the floor timber.

Fig. 4. a and e, the same as in Fig. 3.

Fig. 5. Representing a portion of the lower string with its iron splicing pieces, &c.

a, the outside or exterior splicing pieces, b, the interior splicing pieces, c, the spliced ends of the exterior string pieces, d, the spliced ends of the interior string pieces.

Fig. 6. A side view of one of the interior splicing pieces showing the position of its transverse lugs.

Fig. 7. Representing a portion of the lower string with interior splicing pieces of wood.

a, the same as in Fig. 5, b, the interior splicing piece, which may be furnished with two counter shoulders, as in the figure, with four or with six shoulders, according to the stress to be exerted upon it. c and d the same as in Fig. 5.

Note. The string pieces are confined together by means of screw bolts, passing entirely through the string at the splices and such other places as may be deemed necessary. The beams and floor timbers may also serve as clamps to the strings.

Fig. 8. Showing the manner in which the posts, the main and counter braces, and the lower string are connected.

A, B, a portion of the lower string.

C, D, a portion of the post.

E, a portion of the main brace.

F, a portion of the counter brace.

a, a block supporting the lower extremity of the counter brace, b, c, the key by which the post is kept in close contact with the main brace, and by which the truss frame may be adjusted to its appropriate vertical direction.

Note. The toe of the main brace thrusts against the lower shoulder or step of the post, and the heel against another shoulder behind the block, a, as represented in the figure.

Fig. 9. Showing the manner in which the posts, the main and counter braces, and the upper string, are connected.

A, B, a portion of the upper string.

C, D, a portion of the post.

E, a portion of the main brace.

F, a portion of the counter brace.

c, the key at the head of the post, same as b, c, of Fig. 8.

d, a key passing between the head of the counter brace and the centre string piece, and serving to communicate a thrust or action to the counter brace.

Note. The string pieces, in this and the preceding figures should be so adjusted that the toes of the main braces will be situated at the centres of the former, and their heels at least three inches above the string pieces.

Fig. 10. End views of the post and string pieces projected into each other.

Fig. 11. A view of a portion of one of the strings showing the notches for the reception of the posts.

Fig. 12. A view of a portion of the post showing its neck, or the notches for the reception of the string pieces.

Fig. 13. A view of a portion of the counter brace showing the tongue and shoulder of one end; and the notches for the reception of the main braces.

Fig. 14. A view of the anchor placed in the abutment at B, Fig. 3, to which the iron stay is attached.

Some remarks on the foregoing, by the Patentee.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

SIR,—I take the liberty to offer for publication, in your valuable Journal, a description of the *Jackson Bridge*, together with drawings explanatory of the manner of its construction, and of the adjustment of its parts.

The only bridge hitherto constructed on this plan, has lately been built on the Washington road, about $2\frac{1}{4}$ miles from Baltimore, at its intersection with the Baltimore and Ohio Rail-road, and at an elevation 40 feet above the latter. The length or span of the bridge is 109 feet, its width from out to out 24 feet, and its height from bottom to top of its posts, 14 feet. It is supported by a double truss frame on each side, furnished with arch braces beneath only; the upper arch braces not being required in a bridge of that length. The exterior string pieces of each string are only six inches square, and the interior six by eight inches. The posts at the ends, and at the centre of the bridge, as also the arch braces, are of the size last mentioned. The other posts, and the main braces, are six inches square. The counter and lateral braces are only five inches square. The whole of the timber, except the keys, is white pine, with no other seasoning than what it might have acquired in six weeks, during which time the work was in progress, having been framed and raised in that time by six workmen only. Independently of the

LONGS JACKSON BRIDGE.

PLATE III

Fig. 1.

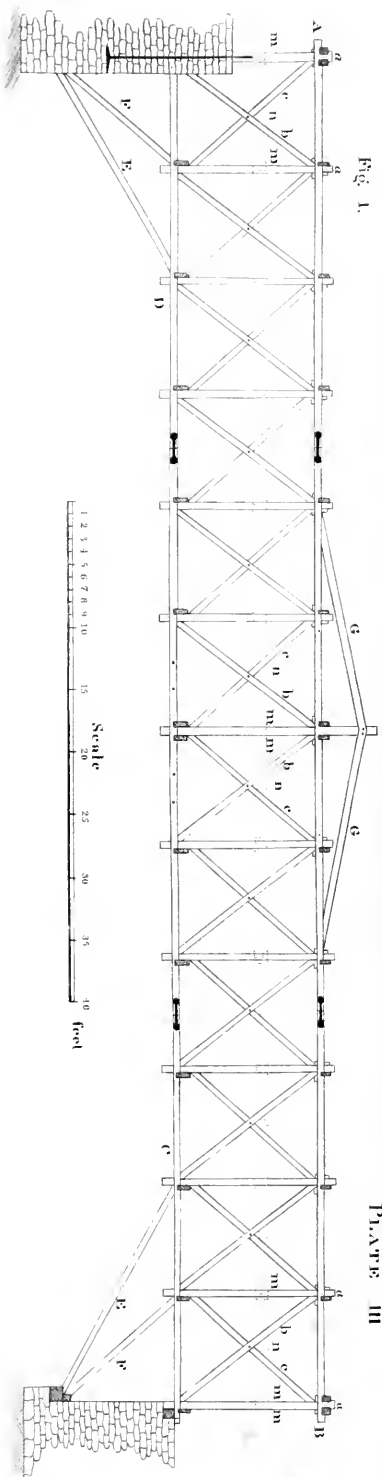
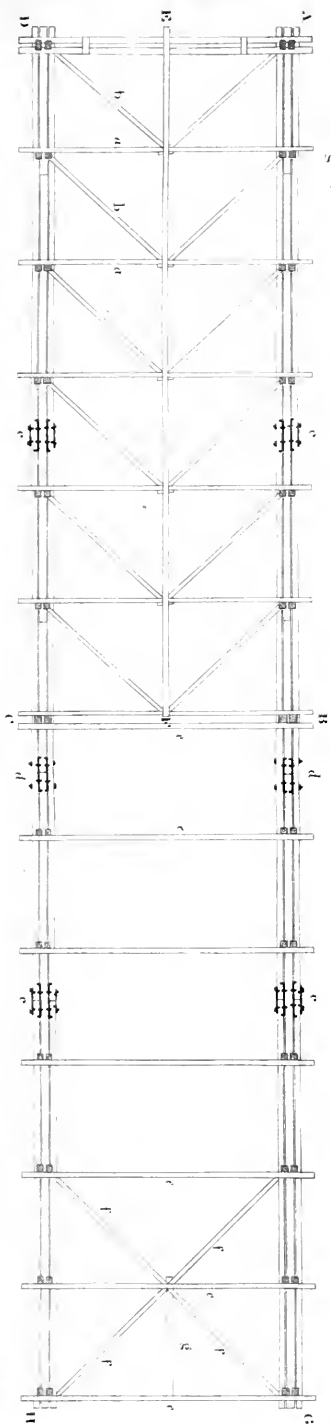
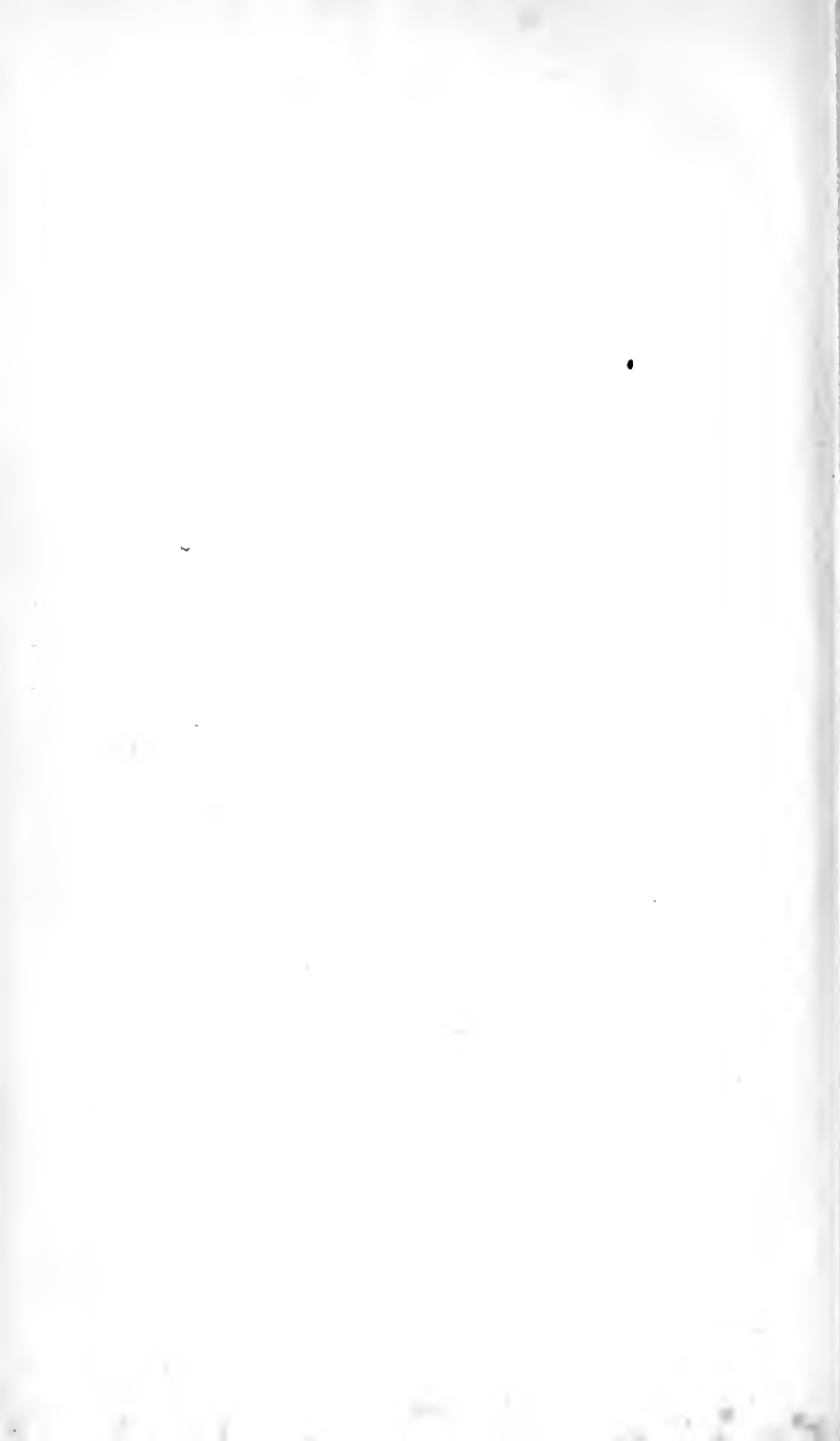


Fig. 2.





LONG'S JACKSON BRIDGE

PLATE III

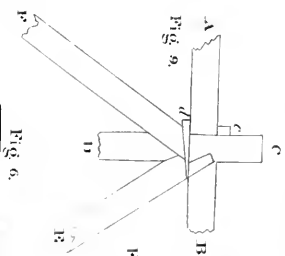
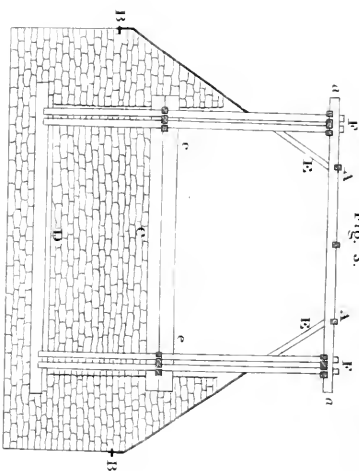
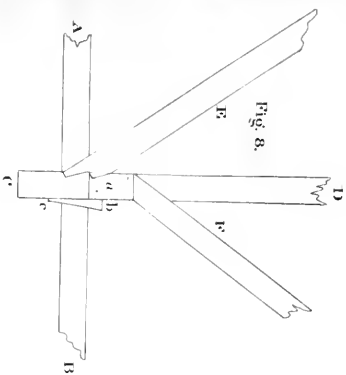


Fig. 14.

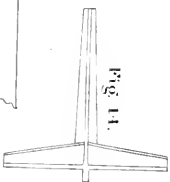


Fig. 1.

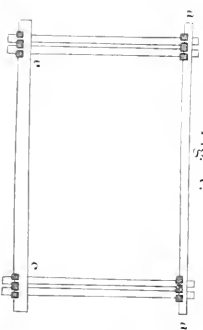


Fig. 7.

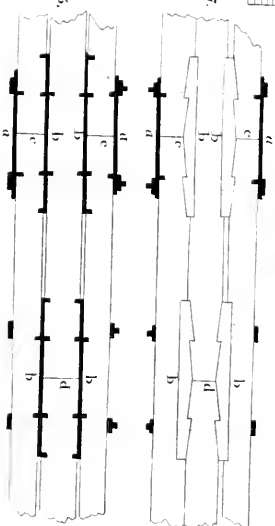


Fig. 5.

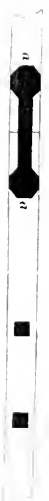


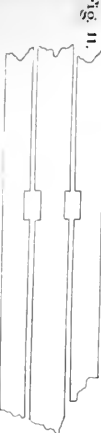
Fig. 12.



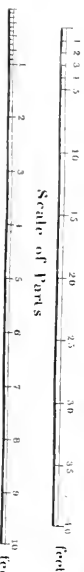
Fig. 13.

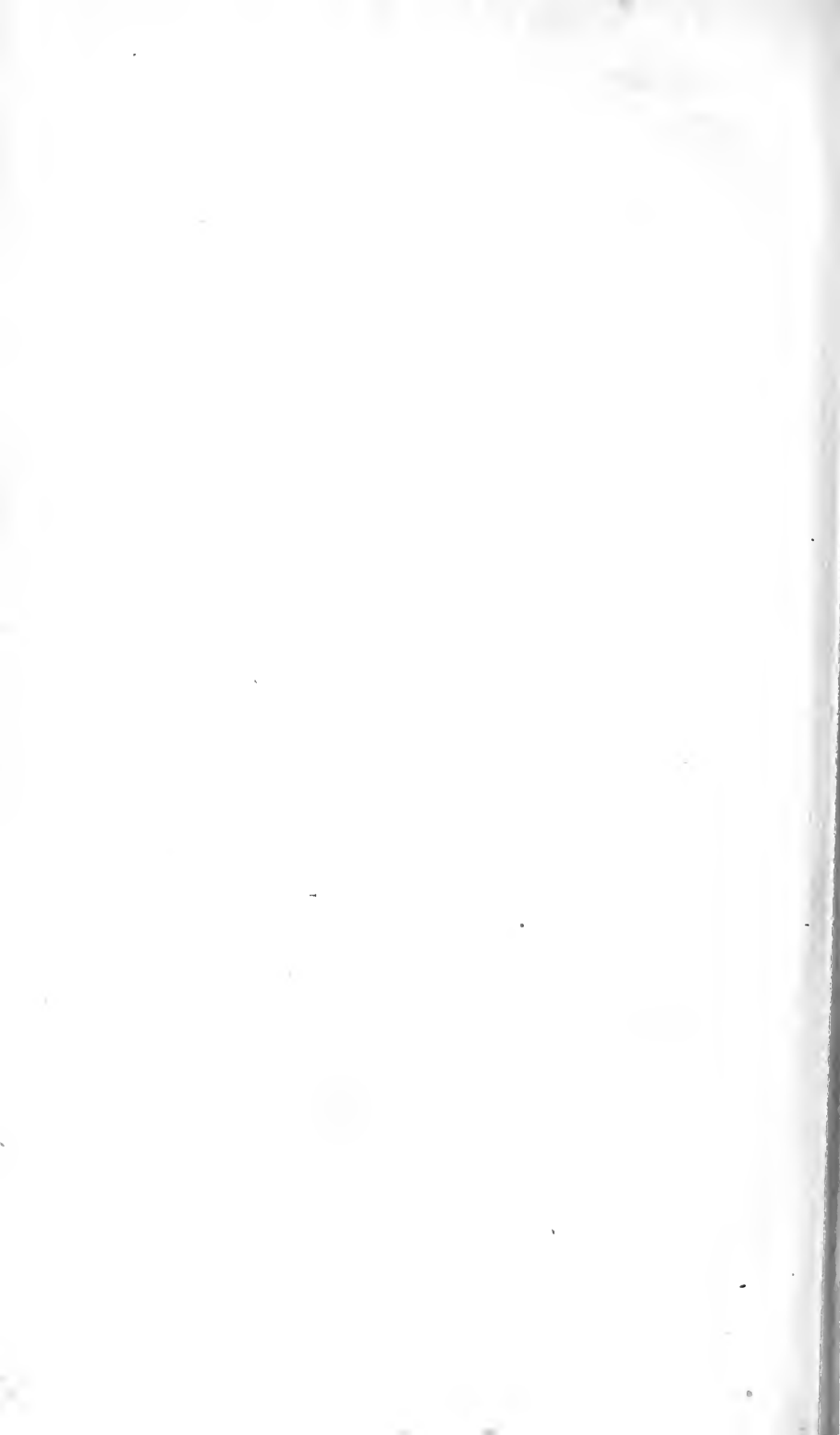


Fig. 11.



Scale of Feet





abutments and exterior covering of the bridge, its cost, inclusive of materials and workmanship of every kind, was only about eleven hundred dollars.

However slender the materials of which this bridge is composed, and however deficient in strength it may appear, it is crossed daily by stages at full speed, and has actually sustained about eighty beeves, driven across it at once, in close gang, without the least apparent yielding in the truss frames.

Agreeably to the most approved rules for computing the strength of similar structures, it will sustain, on every square foot of its floor, in addition to its own weight, at least 130 pounds, or equally distributed over the entire surface of its floor, about one hundred and ten tons weight.

Very respectfully, yours, &c.

S. H. LONG.

Specification of a patent for apparatus for Grinding, or rubbing down Whet stones, Marble, and other hard substances. Granted to BARTON N. FYLER, Bradford, Orange county, Vermont, April, 1830.

To all whom it may concern, be it known, that I, Barton N. Fyler, of Bradford, Orange county, in the state of Vermont, have invented a new and useful apparatus, for the purpose of grinding, or rubbing down, whet stones, marble, and other stones, and hard substances, and which I also mean to apply to the grinding of grain and of other articles which are to be reduced to powder, and also to the clearing or hulling of seeds of various kinds, and also to the grinding to pulp of rags, and other articles used in the manufacture of paper, and I do hereby declare that the following is a true and exact description of my said apparatus.

I make, of any suitable kind of wood, a wheel, or cylinder, which may be in the form of the ordinary mill stone, or of a grind stone, with the end of the grain of the wood forming the surface upon which the grinding is to be effected. When the flat surface or ends of the cylinder are to be used as in the mill stone, the grain of the wood is placed in the direction of the axis of the cylinder. When the periphery is to be employed as in common grind stones, the grain is made to run from the axis towards the periphery, by joining together a number of wedge formed pieces of timber.

I then take pieces of iron, or steel, or of any other metal, generally using pieces of rolled iron about one-eighth of an inch in thickness, about one inch wide, and four inches in length, more or less; these I drive endwise into the end grain of the wood, and even with its surface, allowing a space between them, generally, of one-fourth of an inch, placing or driving them in this manner over the whole surface.

When stone, or other hard substances, are to be ground or rubbed down, I use sharp sand, emery, or other similar article, either with or without water, the hollows or flutes which form in the wood between the strips of metal serving to retain the sand, or other

coarse powder, and to cause it to operate with great efficiency. When I use my combined grinder as a substitute for a mill stone in the grinding of grain, and for other purposes, I give such a form and direction to the pieces of metal as may be thought best to answer the purpose of the ordinary dressing upon such stones; their distance also being varied as judgment or fancy may direct.

The combined grinder is readily dressed or sharpened when used as a mill stone, by running between the surfaces, fine sand, which speedily gives a cutting edge to the metallic strips.

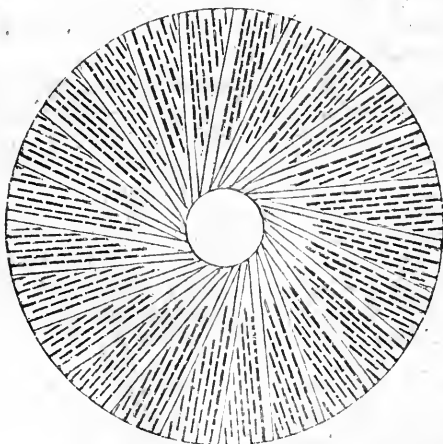
For the grinding or facing of large slabs of marble, I use a wheel of about three feet diameter, with its under flat side formed for the grinding surface; this I attach to the lower end of a perpendicular shaft, which is confined in suitable gudgeon blocks; a swivel joint is connected at the upper end of the shaft, by means of which it is raised and lowered at pleasure, and is put in a revolving motion by any suitable machinery.

Sand and water are applied through apertures at, or near, the centre of the wheel. The marble, or other article to be ground, is carried under the rubber in a level position by a crane of about twelve feet sweep.

The various kinds and forms of marble rubbers now in use, may be constructed on the principle of my combined grinder, and applied in the same manner they have heretofore been used.

What I claim as new, and as my invention, and for which I ask an exclusive privilege, is the formation of a grinding surface, by the combination of wood and of metal; the metal being driven, or inserted, into the end grain of the wood, in the manner and upon the principle hereinbefore described, whether the metal be in the form of strips, or of pins, or in any other shape, and to whatever kind of grinding, a surface so formed may be applied.

BARTON N. FYLER.



The above figure represents the form in which the strips of iron

are driven, as shown in the model deposited in the patent office, but which may be varied as may best suit the intended use.

Remarks by the Editor.—The patentee and his brothers have been long engaged in the manufacture of what are called the “Magog oil stones,” and the “Indian pond scythe stones;” the process of grinding them down, formerly pursued, consisted in holding them upon the flat side of a mill stone of about $3\frac{1}{2}$ feet in diameter, made from granite rock, and supplied with water and sand. Mr. Fyler at length thought of the kind of grinder above described, and upon trying it, was agreeably surprised in finding it to operate in a manner so advantageous as greatly to transcend his expectations: he was, in fact, astonished at the success of his own machine.

Encouraged by this success, he was induced to employ a grinder in the rubbing down of marble, and afterwards as a substitute for burr mill stones, in the grinding of grain, and, as he states, with perfect success; his testimony being fully corroborated by others. Many experiments have been instituted, and are in progress, in order to ascertain the best draught of furrows, and the most proper forms, distances or positions of the plates, or pins. This grinder promises to form one of the best, and most economical, hand corn mills; a machine so much needed in many parts of our country.

There is another important application of this apparatus, in the art of grinding, which will probably become the subject of another patent. Upon this point we shall merely observe, that we have received a specimen of the work performed by it, in an experimental essay, and that this specimen is remarkably good; we hope, therefore, to make known this new application, at an early day.

Remarks on the Pendulous Rail-road Car, and on the adapting Rail-way Cars to run on common roads, &c. described in the last number.
By the PATENTEE.

THE patentee of the above named cars has been much gratified by the favourable opinions expressed by several scientific and practical individuals to whom he has submitted his descriptions and drawings; they have generally concurred in an opinion, that the Pendulous Car is recommended by its simplicity, and have not been able to suggest any objection tending to diminish the confidence which he has entertained, both of its practicability, and its utility. Some have apprehended that the strength of the wheels would be diminished by their increased size, and that they would be subjected to a considerable lateral strain. It must be obvious, however, that the jolts and shocks sustained by a common cart wheel upon ordinary roads and streets, are beyond comparison more violent, than those upon the level surface of a rail-way; and that, from the load of the Pendulous Car being suspended so much below the axle, the lateral strain will be not only far less than upon those of the common cart, but probably not even equal to that upon the wheels of an ordinary rail-way wagon of 2

feet 6 inches diameter, and where the load is uniformly placed above the axles. The objections, therefore, suggested on this account, were, upon consideration, conceded to be of but little weight.

It is difficult at this period, before actual trial has been made, to say what will be the precise maximum advantage gained in case of draught by the Pendulous Car, but we may, I think, approximate to it with considerable accuracy.

It is generally admitted, that with the ordinary wagons, as perfected in England, with wheels of 2 feet 6 inches, or 2 feet 9 inches diameter, a horse will draw with advantage, about 8 tons weight. It must be evident, therefore, that with wheels of 5 feet, or 5 feet 6 inches diameter, turning upon gudgeons as described in the specification, (in which case, the diameter of these, need not be greater to sustain a given weight, than the axles of four-wheeled cars,) one revolution of the wheels will carry the car double the distance forward—or, in other words, that the same load will be carried towards its destination, with one-half the friction. The dust, and the imperfections, inseparable from the surface of the rails, will be surmounted with equal advantage; and we may therefore conclude, that the horse will draw 16 tons with the same ease upon the Pendulous Car, that he could take 8 tons upon the ordinary wagons, with wheels of only one-half the size. Should the load be supported on an axle, instead of upon gudgeons, the diameter of this must be somewhat increased to give it the required strength, in which case the advantage gained in case of draught, would probably not exceed two-thirds of that when gudgeons are employed—or, that the horse's power would be now about $13\frac{1}{3}$ tons.

It is not denied, that wheels of larger size, would give equal ease of draught in proportion to their load, to wagons in which four of them would be used; but it is believed they would add so much to the bulk and weight of such a machine, as to render it less manageable and convenient, in practice, for many of the purposes to which rail-road vehicles are applied. A car with but two of the large wheels, will not occupy more room than the wagons as at present constructed, and will afford even greater facility of being turned, or managed in any way at the point of departure or of destination, by the attendant who has charge of the train.

Should the use of friction wheels be found, in practice, to justify the expectations formed by those who have experimented with them, they may be applied without difficulty to the Pendulous Car, and as the horse's power will, as has been shown, be greatly increased without their aid, by the use of large wheels, the additional power gained by the application of friction wheels, must also be multiplied in the same proportion. There will be this further advantage gained in the application of friction wheels to the cars, that but one-half the number of them will be required as for wagons, although of somewhat increased strength, and consequently an important saving will be effected in the first cost.

The cost of transporting heavy articles, and such as are not of much value in proportion to their bulk, as coal, lime, plaster, stone, &c. &c. will be so much reduced by the use of rail-roads, and the

improvements connected therewith, (a single horse and attendant being enabled to conduct a long train of cars or wagons,) that a serious item in the remaining expense, and more particularly for short distances, must arise from the labour of loading and unloading. An important saving will be experienced, in the facility with which either end of these cars may be brought to within three feet or less from the ground, (simply by tilting, and projecting downward the props or supports at the opposite end,) and which will, therefore, require a less disadvantageous lift, than in the common wagons, where the load must be raised 4 feet or more from the ground. It is obvious with what comparative ease, a labourer will operate in lifting but a short distance from the ground, than when the weight is to be raised to a point, which requires the arms to be extended at right angles with the body.

For the adaptation of rail-road carriages to the common streets or roads, the method last described in the specification, viz. by widening the flanch, is particularly well suited to the use of the Pendulous Car. As the patentee proposes in many instances to construct the spokes and felloes of these large wheels with wood, it is but to make the latter of sufficient width, to admit of two treads or surfaces, one of which acting as a flanch to that running upon the rails, will also have breadth and strength sufficient to support the cars upon the common roads or streets. It will of course be requisite, that both the tread and widened flanch, be bound with a suitable tire or rim of iron, to adapt them to their respective functions; but as the joint width need not exceed $5\frac{1}{2}$ inches, the additional size or weight of the wheels, will scarcely be felt by the horse, in proportion to that of the cars and their loads.

The moveable flanch also, offers a quick and ready mode of attaining the same end, by disengaging it entirely from the wheels of the cars or wagons, if so preferred, when they are desired to pass off the rails. On the removal of a single bolt from the flanch, it may be lifted off the buttons or catches attached to the sides of the wheels, and either be suspended to some convenient place on the sides of the cars, or deposited in the vicinity. On their return to the rails, they may be attached to the wheels again with equal facility. The projecting buttons or catches may be tightened from time to time, by half a turn of the nuts, by which they are secure at the opposite side of the wheel.

The patentee indulges a hope, that the ready means described in the specification, by which rail-road vehicles may be converted into such as are suited to our common roads and streets, will not only save the expense of once unloading and re-loading again, into other vehicles at the termination of a rail-road, (which, in articles of great bulk and of little comparative value, would render the establishment of a depot at that point necessary,) but that the entire city in which the rail-road terminates, would now become the depot, and a great public advantage accrue, from each citizen being enabled to load, or receive loading from the cars, at any point that his warehouses or interest rendered the most advantageous.

SAMUEL T. JONES.

ENGLISH PATENTS.

To JOSIAS LAMBERT, Esq. for an improvement in the process of making Iron applicable at the Smelting of the Ore, and at various subsequent stages of the process, up to the completion of the rods or bars, and for the improvement of the quality of inferior Iron. Dated March 30, 1829.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Josias Lambert, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is described and ascertained as follows, (that is to say):—

The improvement in the process of making iron applicable at the smelting of the ore, and at various subsequent stages of the process, up to the completion of the rods or bars, consists, in the application of salt and potash mixed or combined together, to the iron ore or iron in the blast furnace, the refinery furnace, the puddling furnace, or the balling or re-heating furnace, or in any other process to which iron in its manufacture is subjected, when considerable heat is applied.

The proportions in which I recommend the salt and potash to be mixed or combined, are two parts of salt to one of potash; but should the proportions in some degree differ from that best adapted to the purpose, the useless portions will be dissipated in the process of the manufacture. The mixture or combination employed during the process in the blast furnace, should be applied at the time of the smelting of the materials, which are to produce the iron, at the rate of about fifteen pounds to the ton of iron; and may be introduced in proportionate quantities at the tunnel head of the blast furnace, either at intervals or with every charge of the materials, which are to produce the iron. If not used in the process of smelting, it may be applied at intervals to the metal during the operation in every charge in the refinery furnace, or in the puddling furnace, or to the iron in the balling or re-heating furnace, or in any other process to which the iron in its manufacture may be subjected, when considerable heat is applied. A proper proportion of the mixture to be used in the refinery furnace, may be at the rate of about twelve pounds and a half to the ton of iron; and in the puddling furnace, about eleven pounds to the ton of iron; but in the balling or re-heating furnace, and other processes, the quantity to be applied must depend upon the quality, form, and substance of the iron, taking care that it is sprinkled over and amongst, or brought in contact with the iron; the quantity will vary from about ten pounds to twenty pounds per ton.

The quantity to be applied will differ in some degree, according to the quality of the materials or the iron; but the proportions above mentioned, are about those proper upon the average.

The process for the improvement of inferior iron, consists, in the application of the same mixture in similar proportions to such iron,

when subjected to considerable heat. For this purpose the mixture may be applied to the iron, and the iron melted in combination with it; it may be applied to the iron in any re-heating or other furnace, and the metal then be subjected for a time to a red heat proportioned to the quality, form, and substance of the iron, care being taken that the mixture be applied in contact with the heated metal; and for this purpose, if the iron be in the form of tubes, such as gun barrels, the mixture may be introduced into the tubes.

Although I have mentioned common salt and potash as the substances to form the mixture to be applied, there are other compounds of sodium and potassium, which may respectively be substituted for those materials, which will have the same effect, so that the bases in the compounds are combined together, but I recommend the salt and potash as being the most convenient and economical.

In witness whereof, &c.

[*Rep. Pat. Inven.*

To CHARLES SANDERSON, *Iron Master, for a new method of making Shear Steel.* Dated September 4, 1828.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Charles Sanderson, do hereby declare the nature of my said invention, to consist, in forming shear steel out of very small pieces of bar steel, instead of pieces from one to two feet in length, as heretofore, whereby I am enabled to form shear steel with fewer heats, and, consequently, with less waste, and without the use of silicious sand, as heretofore practised. And in further compliance with the said proviso, I, the said Charles Sanderson, do hereby describe the manner in which my said invention is to be performed, by the following description thereof, (that is to say):—

I take bar steel in the state in which it comes from the converting furnace, and break it into very small pieces of one inch to two inches long, a quantity of these small pieces being ready, I procure a round stone, of any quality which is capable of withstanding the strong heat of a reverberatory furnace, without cracking or breaking, and upon this stone the small pieces of steel are piled as closely and compactly as possible; the whole is then inclosed in a fire clay crucible, and placed in a reverberatory furnace, where it is allowed to remain until the whole mass becomes of a high welding heat; it is then taken from the crucible and placed under a heavy cast iron hammer, usually called a metal helve, and exactly the same as those used in the manufacture of bar iron; this hammer is driven by machinery, and from the circumstance of the whole mass being in a semi-fluid state, it is almost instantaneously hammered or manufactured into one solid mass or bloom of steel, of from three to four inches square; this bloom is placed in a furnace, or as it is more generally termed, a hollow fire, of two or three feet square, heated with coke, and the heat increased by the application of a blast of air, and the whole mass or body of the steel so hammered or manu-

factured as aforesaid, is raised to a high welding heat; it is then taken from the furnace and placed under the same metal helve or hammer before mentioned, and drawn into a bar of shear steel, ready to be tilted or rolled into the various sizes or shapes which may be required. For shear steel to be used for inferior purposes, it might be too expensive to place the piled steel in a crucible, but it might merely be placed in a reverberatory furnace, and drawn thence when it is of a complete welding heat. Shear steel made in this manner being very superior in quality to that made in the ordinary way, and the process herein described causing much less waste than that heretofore adopted, I hereby claim as my invention, the said process or method of manufacturing shear steel; and such my invention, being to the best of my knowledge and belief, entirely new, and never before used within that part of his said majesty's United Kingdom of Great Britain and Ireland, called England, his said dominion of Wales or Town of Berwick upon Tweed. I do hereby declare this to be my specification of the same, and that I do verily believe this my said specification doth comply in all respects fully and without reserve or disguise with the proviso in the said hereinbefore in part recited letters patent contained; wherefore I hereby claim to maintain exclusive right and privilege to my said invention.

In witness whereof, &c.

Observations by the Patentee.—It might be well to observe, that the cost to the consumer of shear steel will be very much decreased in consequence of the facility afforded by making it in the patent way. The steel must of necessity be much better, as in this process it is subjected to less heat, and consequently less liable to be what is technically termed "burnt." From the large quantity of this kind of steel used by the Sheffield and Birmingham manufacturers, the discovery must be of great use to those towns; and it is wished that no prejudice may exist against the new mode (in consequence of its difference from the old one,) but that it may be submitted to an unprejudiced trial. [*Ib.*

To JAMES GRIFFIN, Scythe Manufacturer, for an improvement in the manufacturing of Scythe Backs, Chaff-knife Backs, and Hay-knife Backs. Dated April 26, 1828.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said James Griffin, do hereby declare, that my invention is fully described and ascertained by the following description thereof, (that is to say:)—

My invention consists, in forming scythe backs, chaff-knife backs, and hay-knife backs, with raised studs or pegs, for the purpose of rivetting the cast steel blades thereto, and which studs or pegs form part of, and are solid with the said backs. In order that my invention may the better be understood, I will first describe the manner

at present in use for making backs, and then proceed to describe my improvement, whereby my invention will be readily understood, and so that a person conversant with the manufacturing of scythe backs, chaff-knife backs, and hay-knife backs, may be able, from this my specification, to make and execute my invention. The usual manner for forming the backs for cast steel scythe blades,* is by welding, or making a piece of iron into the shape required, and then by drilling, or by some other means, forming holes at proper distances; which holes are for the purpose of receiving the studs or pegs by which the blades are rivetted to the backs; now it is evident that the backs thus perforated must be considerably weakened, as in each place where a hole is formed there is nearly a third of the width of the metal removed.

The object of my improvement, is, to construct the backs with raised studs or pegs which are solid with the backs; consequently backs so formed, will be found much stronger than those which are perforated for passing the studs or pegs through for the purpose of rivetting on the blades. The manner I have found to answer best for making backs according to my improvement, is, by passing iron (or other proper metal,) heated to a welding or proper heat, through a pair of rollers prepared in the following manner:—

I cut a groove around the circumference of one of the rollers to the size and shape required, and sink small holes at proper distances, so that when the heated iron (or other proper metal,) has passed between this grooved roller and a plain roller, it will come out with raised or projecting studs or pegs on one of its surfaces, which studs or pegs are formed by the metal being passed into the sunk holes. The end of the back is then to be formed by welding and forging it to its proper shape, and the back is to be cleaned by rough filing, and will then be ready for having the blade riveted thereto, which is done by beating down the studs or pegs, and making them spread over the holes formed in the blade. I have here only described my improvement as applicable to a scythe back, and have to add, that the same description will apply to chaff-knife backs, and hay-knife backs, they differing only in shape. I have also advised the making of the backs by means of rollers, considering that to be the best and most perfect manner of forming them; but I would have it known, that I do not confine myself to that method, but would have it understood, that I consider my invention to be, and limit my claim to, the forming or manufacturing the backs of scythes, chaff-knives, and hay-knives, with raised studs or pegs, which form part of, and are solid with such backs.

[*Ib.*

To WILLIAM STOREY, Plumber and Glazier, and SAMUEL HIRST, Clothier, for certain materials, which when combined, are suited to be employed in Scouring, Milling or Fulling, Cleansing and Washing of Cloths and other Fabrics, and by the employment of which material considerable improvement in those processes is effected.
Dated March 10, 1829.

THESE materials consist of a saponaceous mixture, compounded of alkaline matters, with a small quantity of fat, and the following method of preparing it, is nearly a verbatim copy of the specification.

A large cistern being procured and filled with human urine, the latter is allowed to stand in it for about six weeks, in order to produce fermentation; when this has thoroughly taken place, about four hundred gallons of the fermented urine is to be transferred to an iron still, with a block-tin worm passing through a refrigerator, of the usual construction; to this is to be added one pound of tallow, prepared from beef suet, for the purpose of preventing the froth that would otherwise arise in ebullition. This mixture is to be distilled, and whilst in operation, about six gallons of the aqua ammoniæ thus produced, are to be drawn off into a cask, adding six pounds of the best mottled soap, previously dissolved. This will give it an opaque appearance, and produces, as the patentee asserts, an excellent saponaceous material for cleansing and dressing woollens. The casks should be bunged up to exclude the air. [Ib.]

To THOMAS ROBINSON WILLIAMS, Esq. for improvements in the making or manufacturing of Felt, or a substance in the nature thereof; applicable to the covering the bottoms of vessels, and other purposes. Dated May 21, 1829.

THESE improvements consist in passing the hair, wool, cotton, hemp, or other material intended to be manufactured, between two endless webs of woven wire, immersed in tar or pitch, in such manner that only a proper quantity of the latter shall be imbibed; and also by the use of glue or size, instead of tar, &c. in forming a material which may be used for mill-board, paste-board, and floor-cloth.

The machine the patentee uses for these purposes, consists of a vessel for containing the pitch or tar, which is placed on a frame, and is heated either by coils of steam pipes placed within, or by a fire immediately below it. Near one end, and immersed in the liquid contained in the vessel, is a roller, under which a web of woven wire passes, for conducting the felt through it, and towards two pressing rollers placed near the other extremity, but above the liquid; another web of wire passes under the upper one of these, and the two webs having rotary motion imparted to them, convey the felt through the pressing rollers, in order to squeeze out all the

superfluous tar, which drops again into the vessel, while the felt is conveyed off to a table, where it is then ready to be cut into sheets, or whatever form may be required. A series of conducting rollers are used for facilitating the admission of the felt. The patentee does not confine himself to any particular machine for spreading the material, but states, that either a carding engine, blowing machine, or devil, may be used for that purpose. [1b.]

FRANKLIN INSTITUTE.

Monthly Meeting.

The stated monthly meeting of the Institute was held on Thursday evening, February 25, 1830.

Mr. WILLIAM NEAL, was appointed chairman, and

WILLIAM HAMILTON, Recording Secretary, *pro tem.*

The minutes of the last meeting were read and approved.

Mr. Edward G. Dorsey presented the *History of Pennsylvania, from its Discovery by Europeans, to the Declaration of Independence in 1776, by Thomas F. Gordon.*

The corresponding secretary stated that owing to the obstruction of the Delaware by ice, the European exchanges had not been received during the past month.

Professor Johnson, of the committee on inventions, reported that the committee had prepared a report on Mr. Woodward's machine for Planing and Grooving Boards, but the patentee having removed the model for a short time, they declined presenting the report until the next meeting, at which time the model will be returned and submitted with the report.

Mr. Charles Potts submitted a paper in reply to the query referred to him at the last meeting, viz. what is the difference between the absolute efforts employed to move a locomotive engine, when the force proceeds in one case from the engine itself, and in the other, from a stationary engine, supposing the plane over which the motion takes place to be horizontal? which was read, and after various remarks, was referred to the committee for publication.

The committee on subjects for discussion, submitted the following, which were accepted and referred, viz.

What is the best unguent, and the most economical mode of its application, to diminish the friction of rail-way cars, locomotive engines, and other machinery of a similar construction?

What is the best method of proving, experimentally, the force of percussion?

What is the best mode of measuring the energy exerted by mechanical movers, while the machinery impelled is in motion?

Extract from the minutes.

WILLIAM NEAL, *Chairman.*

WILLIAM HAMILTON, *Recording Secretary, pro tem.*

Reply to the question, What is the difference between the absolute efforts employed to move a Locomotive Engine, when the force proceeds in one case from the engine itself, and in the other from a stationary engine, supposing the plane over which the motion takes place to be horizontal? By Mr. CHARLES POTTS. Read at the meeting held February 25, 1830.

TO THE FRANKLIN INSTITUTE.

WITH regard to the efforts of a stationary and of a locomotive steam engine in producing motion along a horizontal plane, allowing the powers of the two engines to be equal, and that the operations of the locomotive engine can be performed with the same regularity and freedom when travelling as when fixed and stationary; allowing also that the friction of the wheels of the locomotive carriage on the rails is fully adequate to the power of the engine, it must be obvious that the absolute difference between the efforts of the two engines will on the one hand be commensurate with the difference between the amount of friction due to the weight and motion of the chain or rope necessarily appended to the stationary engine, and constituting part of it; and on the other, to that of the friction due to the weight and motion of the locomotive engine itself. When these, therefore, are equal, the absolute efforts of the two engines on the horizontal plane will of course be equal. Hence, also, it may be inferred that on a horizontal rail-way of considerable length, the locomotive carriage must have the advantage decidedly.

This question, however, is intended to embrace more particularly the difference between the efforts of stationary and locomotive *animal* engines.

When a horse, for instance, draws the carriage after him, as in the ordinary mode of tracking, or when his efforts exerted in the same manner are employed at some fixed point of the horizontal plane to turn a drum, from whence, by means of chains or rope, his power is transmitted, then we have the case of a stationary engine; but when the horse is compelled to travel on an *elastic inclined plane*, mounted on the carriage, and by the joint efforts of gravity and his animal powers, urges the carriage forward, we have that of the locomotive engine.

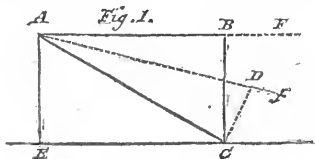
Now in order to determine which of the preceding methods of applying the action of the horse, would be most advantageous in propelling the carriage along the plane in question, we shall first consider the manner and measure of his force, when his efforts are employed as in the first of the foregoing cases answering to that of a stationary engine, viz. when drawing the load after him along the horizontal plane.

It is to M. Deparcieux that we are principally indebted for correct information on this part of our subject. He has shown in the most satisfactory manner that animals draw by means of their own *weight*, and not by the force of their own muscles, as some have

contended. This supposition which renders their action entirely mechanical, will enable us more readily to subject their efforts to mathematical investigation.

The hinder feet of the horse are considered the fulcrum of the lever by which his weight acts against the load. The length of this lever being equivalent to the distance between the centre of gravity or chest of the horse and the hinder feet.

Thus in Fig. 1, suppose the load attached at F, the line of traction AF, and that BC represents the hinder leg of the horse, AB part of his body, A, his chest or centre of gravity, and CE the level road. Then ABC will represent the crooked lever by which the horse acts, which is equivalent to the straight one, AC.



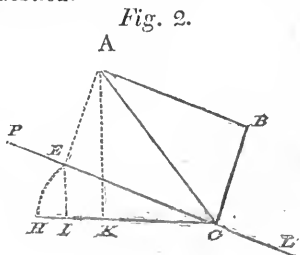
Now when the animal lowers his centre of gravity, which he always does when he pulls hard, his weight acts downwards at A, round C as a centre, and drags forward the load at F. Hence on the principle of the bent lever, CE will represent the power of the lever in this position, or the lever of the horse's weight, and CB the lever by which it is resisted by the load.

M. Deparcieux found, experimentally, that the most favourable position of the traces, or the *line of traction*, was obtained when the angle BAf was fourteen or fifteen degrees.

From the above illustration, it may be inferred that *large horses will draw more than small ones, even though they have less muscular force, and are unable to carry such a heavy burden.* The force of muscles tends only to make the horse carry continually forward his centre of gravity, or in other words, the weight of the animal produces the draught, and the play and force of the muscles serve to continue it.

Suppose now the horse is made to ascend the inclined plane, as in the case of the locomotive engine already defined. It is evident that as the inclination of the plane increases, the power or lever of his action will be diminished. Hence, in order that the whole amount of his mechanical and muscular force may be kept in equilibrium, we must suppose his muscular force to have been increased in the same ratio. This supposition, however, it is clear, is perfectly inadmissible, inasmuch as we suppose an equality between the absolute powers of the two engines in question.

Let PL (Fig. 2,) represent the inclined plane upon which the horse is supposed to travel. From A, the centre of gravity of the horse, let fall AK perpendicular to the horizontal line, CK. Then will CK represent the mechanical effort of the horse to urge the plane from P to L. The force or action of the horse on the plane, which



arises entirely from the gravitation of his weight, will be as the sine of the angle of inclination; that is, as EI. This quantity is also equivalent to the difference of the muscular force which the animal must exert when travelling up the inclined plane, and when moving on a horizontal one, so that when the absolute powers of the stationary and locomotive engines are equal, we shall have the absolute efforts of the first to the latter, as CE or CH to CK.

Even allowing the quantity EI to be added as a force due to the inclination of the plane, it is sufficiently obvious that the *resultant or sum of the two forces* must always be *less* than that due to the force of the animal alone when employed in dragging the car after him, as in the ordinary mode of tracking.

Very respectfully,

CHARLES POTTS.

February 25, 1830.

On the pressure exerted upon an Inclined Plane, by a Descending Body. By THOMAS W. BAKEWELL.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

SIR,—If you do not think the question of pressure on an inclined plane, by a body in motion, exhausted, please give the following a place in your Journal, as *à propos* to the subject.

Bernoulli showed by experiments before the Academy of Petersburg, that when water moves with any velocity in a canal, the pressure which it exerts on the bottom and sides of the canal is less than when the water is at rest; and that the pressure decreases according to the velocity. Bossut has obtained similar results, and M. Romme, in his "*Art de la Marine*," gives the results of experiments showing the decrease of pressure on the bottom of a vessel floating in water, by the velocity of the current, and arrives at the value of this decrement by experiments with a tube or tubes, open at both ends, one end of which is immersed to a given depth in water, with a float resting on the water, inside the tube, to which is affixed a rod, or scale, rising above the upper end of the tube.

The integrity of the above authority, we have no right to doubt; but the correctness of the results of the experiments, at least from the cause assigned, is very questionable.

If we suppose a circular trough, containing water, and balanced in scales, the water being at rest, I think it is not hazarding much to say that no alteration of weight would be discovered by any velocity we might give to the water. Otherwise, a mill stone in motion does not press on the spindle in the same degree as when the stone is at rest.

With respect to a vessel sinking deeper in a current than in still water, I am not prepared to answer in the negative. The roughness or asperities on a ship's bottom, will, in a current, create a coating of dead, or eddy water, which may produce the alleged effect; but

the dead, or eddy water, is caused by its deflection from a line parallel to the bottom of the ship, the reaction of which, on the ship, would, I should suppose; be equal to the loss of pressure by the deflection.

I am the more inclined to believe that the experimenters have been deceived, from the circumstance of the sinking of the water in the immersed tube, having been taken as a test applicable to the vessel. The water would be deflected downwards by the end of the tube, leaving a space of eddy water at its mouth in contact with the passing current, which by its cohesion, or friction, (or both) would diminish the quantity of water under, and in the tube.

An error might also arise in ascribing the increased height of the water, shown on the stern post (a fact which always occurs) to a diminution of pressure on the bottom, whereas it is owing to the momentum of the water following the rising lines, as they lead to the transom and stern post.

That the motion of a body on an inclined plane, does not affect the pressure, has been conclusively demonstrated by several writers in this Journal; permit me, nevertheless, to exhibit another view of the case.

Fig. 1.

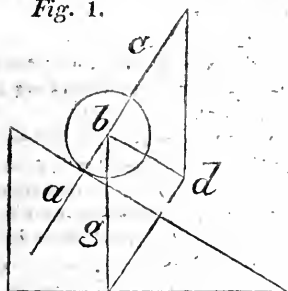
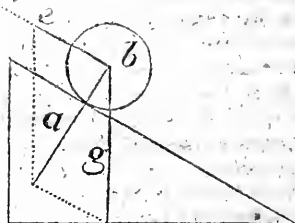


Fig. 2.



Let the height of the plane, Fig. 1, represent the weight of the ball, b . It is then assumed that the pressure of the ball is perpendicular to the plane, and is, in intensity, represented by a , = to the sine of the angle of inclination making the base radius. Now if we consider this force, a , represented by an equal force in an opposite direction, as c , and draw the line, g , equal to gravity, we have two sides of a parallelogram, which may be completed, as in the figure, and the ball will be urged in the direction, and with the force of the diagonal, b, d . I conceive that in the solution of this problem, it is only necessary to prove that the direction of the ball, by the operating causes, would be parallel with the plane; when this fact is established, the variation of pressure by velocity will not, I should think, be a question, and that this would be the case, is evident by our being able under the forces, c and g , to remove the plane, when the ball would continue to move freely in the direction of the diagonal, d , and parallel to the plane.

I observed that the direction and value of force a , Figs. 1 and 2, were assumed. We arrive at this force by considering the ball at

rest, g , being gravity, Fig. 2, and e , the force to prevent its rolling down the plane, which is sustained in a parallel direction, as e, f . a , is the diagonal of the two forces, e and g , and is compounded of them.

Now the question arises, is the ball under the same conditions with respect to the plane when detached from the sustaining force, e, f , as when held by some resisting object in the direction, e, f , by a force equal to e ? If we cut the supposed line, f , and leave the ball free on the plane, does the force, e , exist? If not, a will vanish, and the plane be pressed only by the force and direction of g , and so of all planes, however inclined, or horizontal. I reply that the conditions of the ball are the same, and that the force, e , or resistance to its descent, exists in the inertia of the ball.

For let the length of the plane be to the height as 8 to 4, the weight of the ball 4, then a force equal to 2, parallel to, and up the plane, is required to sustain it against the force 2, by gravity down the plane. The force 2, by gravity, is a *constant force* down the plane; but no force can exist, without an equal resistance; there is no cause of resistance but by the inertia of the ball, therefore the inertia of the ball is that resistance.

Again, place the plane, with the ball on it, in a balance; let the plane be prevented from moving horizontally, but perfectly free to move vertically (up or down,) suppose the ball, as before, to weigh 4 lbs., then a line attached in the direction e, f , to a resisting object, not connected with the plane, and drawing with a force of 2 lbs., will take off 1 lb. from the whole weight shown by the balance. Query, will the whole weight on the balance remain the same if the line e, f , be cut, which took off 1 lb.?

I reply in the affirmative.

I have always defined inertia to be "that property in matter which causes a *resistance* to change, either of rest or motion. The term resistance has been objected to, as of too active, or positive, a signification. The "passiveness" of matter has been urged in its stead as better conveying an idea of this property.

I have no wish to dispute about terms, and will, therefore, apply the words passiveness and resistance, in contrast, when we shall be better able to decide on which is the most apposite.

We will suppose inertia, and also gravity, constant quantities at the earth's surface; a body will fall say 16 feet in 1" of time, and acquire a velocity at the end of the time of 32.

Let inertia remain constant, but gravity be decreased one-half, then the body will descend only 4 feet in 1", and the velocity at the end of the time be 16.

But we can suppose gravity to be the same as at first, and inertia to be doubled, then the body being twice as "passive" (resisting) will only fall 4 feet in 1", and the velocity at the end of the time be 16, as in the last example.

We can again suppose gravity constant as at first, and inertia diminished one-half; the body in this case, having lost one-half its

"passiveness" (resistance,) would fall 64 feet in 1", and have acquired a velocity at the end of the time, of 64.

Hence it would follow that if matter were entirely divested of this property called inertia, a body would be attracted through any space, however great, without time, an absence of resisting media being supposed. But as inertia now exists, we find that matter at rest is brought to given velocities in the ratio of the power applied, multiplied into the time of its acting, and that matter in motion is reduced to rest, by an opposing force in the same ratio.

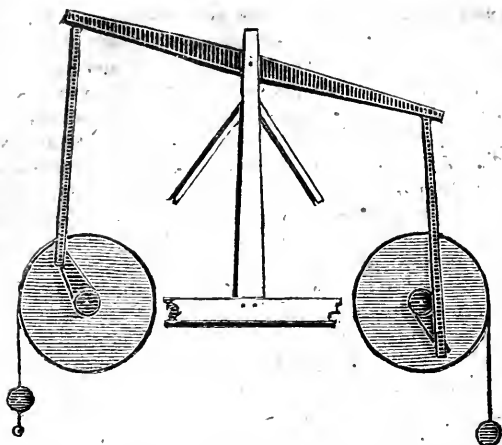
Cincinnati, February 13, 1830.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On Computing the Power of High Pressure Steam Engines, with remarks on a former article upon that subject.

MR. EDITOR,—Some time ago a friend of mine showed to me a piece in your Journal about the computing of power of high pressure engines. I could not understand much about the calculations, because they were nearly all made with letters, instead of figures, which is a method that but few of us old engineers understand, which, however, may be very useful to young engineers, as they have mostly better opportunities of school learning than we had in old times. In some parts of his piece the author has given his opinions, in part, in writing, which I understand better than I could his calculations with letters. He says, when the piston moves with "one-third of the greatest velocity with which it is capable of working, then will the work done be a maximum, or the greatest possible." To prove this, he states a case where a less pressure on the piston has given more power in a given time, by one-third, than a greater pressure gave in the same time, with a slower motion; this certainly shows that the same engine will do more work in the same time when the piston moves fast than when it moves slow, but it does not show that it will do more work with the same quantity of steam, which I suppose is what he wants to prove by these letters; for at any rate it will be of more value to show how to do the most work with the same steam, than to show how the most work can be done with an engine, without regard to the quantity of steam; for every body knows that the faster an engine runs, the more work it will do in a given time if it be fully supplied with steam, and every body knows also, that the faster an engine runs the more steam will be required to run it. If I understand our engineer, he thinks, and tries to show, that when the piston is moving so fast that 150 pounds of steam in the boiler can press the piston no more than 100 pounds, that this is a better way to work the engine than when the 150 lbs. in the boiler will press the piston 149 pounds; this I don't think he has shown, nor do I think he can show it in any other way than by his letter calculations, which is to me no better than not showing it at all. I have always thought that there was a waste of power (or of steam, which is the same thing) when the force on the piston is not nearly as great as it

is in the boiler; for any body can see that if you open the throttle valve so little that the steam will only press the piston 10 lbs. when there is 150 lbs. in the boiler, and just before the stroke is finished, the valve is opened so far that the steam will flow in and fill the cylinder with 150 lbs. pressure by the time the stroke is finished, that there will be just as much steam used as if the opening had been large the whole time, and the piston pressed 150 pounds the whole distance; now something like this takes place when an engine runs so fast that 150 lbs. in the boiler, at the middle of the stroke, can only press the piston 100 pounds, for as the piston comes near the end, the motion becomes very slow, and gives time for the steam to flow in and fill the cylinder with the steam much over 100 lbs. most of which must be wasted. This engineer also shows by his letter calculation, that there is one-fifth of the power lost by the "nature of the crank motion," and in the "lever beam construction," the loss is more than one-third; now I think if he would apply what he calls his formula fairly to the crank, it would show him that he has not applied it rightly. If he will divide the cylinder lengthwise into four, or any other number of equal parts, and multiply the force on the piston by each one of these parts, beginning at one end, he will find the quantity of power, which acts on the crank and tends to turn the shaft, to be the same for each division of his cylinder; for the connecting rod always presses with the same force on the crank, and the quantity of force applied to the crank in each division of the cylinder, will be found by multiplying the force by the distance the connecting rod has moved the crank in the circle, and the tendency of this force to move the shaft round, will be in proportion to the different leverage at which the force acts. When the piston comes to move through the middle division of the cylinder, the rod will press the crank with the same force as before, but it will not be moved through so large a part of the circle, and will have a greater tendency to move the shaft round than before, because it will act on a longer lever. I am therefore sure his letter calculation, if properly made, will show him that there is no loss in the crank motion, nor even in the lever beam, except what arises from friction. If, however, he cannot satisfy himself in this way; if he can persuade the Professor of Mechanics, Mr. Johnson, (I believe is his name) to make a machine something like the figure in this paper, and try it with weights, he will find that any weight that will turn it part of the way round, will turn it entirely round, and keep it going round as long as the weight acts; if this should be the case, and he shall be still of the opinion that there is a loss of power in one of the cranks, he must also hold the opinion that the other one is a gainer of power. In order, however, to satisfy himself that both ends of the lever beam, as well as both the cranks, are alike in effects as well as in appearance, he may hang the small weight first on one pulley, which it will turn, and then on the other; if they both turn alike, and he still be not convinced, I know not "where, how or when" he will be.



Let the wheels be pulleys, with a cord wound round each, and equal weights fastened to each cord, the wheels, cranks, and beam, would be held still in any place they may be put, but let the small weight, seen at the bottom of one of the large ones, be heavy enough to overcome the friction of the machine, and the whole will begin to move, neither easier nor harder, faster nor slower, on account of the different places of the cranks. So then, the machine will be at work with all the "natures" belonging to the crank; the weight going down takes as much up, except the small weight which is equal to the friction only.

AN OLD ENGINEER.

Abstract of a lecture on the Manufacture of Pins, delivered by Dr. BIRKBECK, at the London Mechanics' Institute.

In a recent lecture of Dr. Birkbeck's, at the Mechanics' Institute, while pointing out the advantages to be derived from the use of machinery as a substitute for human labour, he adverted to the various processes employed in the fabrication of a pin. He observed:—

"It has been stated that no less than eighteen individuals are employed in the manufacture of this little implement, some have extended this number to twenty-five, but they must have included processes which occur previous to the drawing of the brass wire. The manufacture of wire, by drawing it through a steel plate fixed perpendicularly on a table, is supposed to have originated at Nuremberg or Augsburg, in the fourteenth century, but the present mode of drawing it through a steel plate, by the addition of revolving cylinders, urged by horses, water, or steam, is of comparatively recent invention. This draw plate is pierced with a number of conical holes of different sizes, the size of the smaller orifice determining the diameter of the wire, which is seized by a strong pair of nippers, and forcibly drawn through these holes when the plate is

placed on the draw frame. As the pin maker requires a very small shaft for his pins, the wire is made to pass through the smallest holes in the draw plate; it then requires to be made straight, and the business of the pin maker commences by cutting it into lengths sufficient to make six pins." One of these steel draw plates was exhibited to the audience, after which it was placed on a draw frame, and a piece of thick wire was dragged through several of its orifices in succession, and was elongated in proportion to the diameters of the holes through which it had passed. By this process the wire became so much heated that the lecturer could scarcely hold it, and he observed that, "the evolution of heat arose (as in the operation of hammering) from the approximation of the particles of the metal by the violent pressure it had undergone, which had forced out its latent caloric and rendered it sensible. Lord Bacon, according to his view of the nature of heat, concluded, that the rapid change of temperature, which accompanies hammering, was occasioned by a rapid vibration of particles; but in drawing wire, there is no vibration at all commensurate with the quantity of caloric evolved. Gold and silver wire, after undergoing this process (which does not diminish malleability or ductility) is frequently flattened, by passing it between two steel cylinders revolving very near to each other: this was a very important improvement, as the fine and costly wire used in forming gold lace is made to cover three times as much space as if in a cylindrical form.

"The boy who points the pins, takes about a dozen of the lengths of wire in his hand at once, and a spectator is astonished by the dexterity with which he contrives to keep them all revolving on their longitudinal axes, while he applies their extremities, first to a coarse grinding stone, and then to a finer one, revolving near the other on the same axis, to give them the necessary polish. The revolution of the wires is necessary to prevent the ends from being ground flat, and so rapidly is the operation performed, that a boy will point 16,000 pins in an hour. As soon as the two ends of the wire are pointed, a pin is cut from each extremity, and the pointing is repeated till six pins are cut from each wire.

"The process of making the heads of pins, or, as it is termed, head-spinning, consists in causing a finer wire to revolve with great rapidity round a straight piece of wire of proper diameter, which is afterwards drawn out, leaving the spiral coil in the form of a hollow tube, which is then cut into pieces, every two rounds of the wire making one pin's head. The heads are then put into an iron pan, and made red hot to soften them, after which they are ready for use; and the next important point is to fix them properly on the shafts. In the year 1543, it was enacted by statute 34 and 35 of Henry VIII., cap. 6, 'That no person shall put to sale any pins but only such as shall be double headed, and have the heads *soldered* fast to the shank of the pins, well smoothed, the shanks well shapen; the points well and round filed, canted and sharpened.' But in our times, no man could get a living at pin making, if he had to *solder* the heads on, or fix them by riveting. All that is now required is

for a boy to thrust the shaft of a pin amongst the heads, and catching one of them on its extremity, he fixes it firmly by striking it with a hammer on an anvil with a small hole in it. This is done with surprising rapidity, and the principal cause of the firm adhesion which takes place between the head and the shaft, appears to be the attraction of cohesion allowed to operate by the closeness of contact.

“When the pins are thus completely formed, they are whitened, placing them in a vessel containing a solution of grain tin in tartaric acid, or the lees of wine. In this process we have an advantage, as to brilliancy of surface, over the continental pin makers; who use lead and mercury instead of tin; and it is said, likewise, that on this account, a puncture from a British pin is of much less consequence than when made with a foreign one. The pins, when thus whitened, have still a dull appearance, which is removed by agitating them in a tub containing bran; and the pins being thus polished by friction, the bran is detached by winnowing, exactly as chaff is separated from grain. The pins are then ready for the final process of papering, an operation not easily understood, as to the mode of folding the paper and the rapid introduction of the pins, without seeing it actually performed.”

Dr. Birkbeck unfolded a paper containing four hundred and three common pins, and stated, “that after paying all the expenses of wire, labour, &c. incurred in the processes just described, the whole sum charged by the wholesale dealer, from whom they were obtained, for this quantity of pins, amounted to no more than *two-pence farthing*. They are, therefore, sold in the first instance, at the rate of forty-four and a fraction for *one* farthing, producing, consequently, somewhat less to the manufacturer; and it may be asked, if pins are so cheap, what necessity is there for the aid of machinery in manufacturing them? If the question referred only to the consumer, the answer must be, “none.” It would seem, indeed, from the smallness of the price of pins, either that the capitalist must lose by making them, or that his workmen must be miserably paid for their labour; and it appears from a statement published in 1813, respecting the state of the pin trade at Gloucester, where one thousand five hundred hands were employed in it, that the trade was scarcely worth following. Here then the improvements of machinery ought to apply, as not only affording opportunities for a more advantageous investment of capital, but as producing a superior manufacture of the article in question.” The lecturer here produced another paper of pins, containing four hundred and eighty, which were sold for *nine-pence half-penny*, or at the rate of about twelve and a half for a farthing. In this sample, as well as in several other specimens of patent pins exhibited to the audience, the perfection of the heads enabled the manufacturer to obtain a better price; for the great difficulty in pin making is to fix the head firmly, and in regard to what may be called the machine made pins, without leaving it in a ragged state.

“There is a large manufactory on the Surrey side of Blackfriars’ bridge, where pins are made by machinery; and if this establishment, which could supply the whole consumption of the nation

(estimated at *sixteen millions* of pins per day,) were in full action, it may be inquired, what is to become of all the operative pin makers? The answer to this inquiry is, that they must have recourse to other employments, and, driven from this starving occupation, it is probable they would find another, more productive as to wealth, and less oppressive as to labour. The manufacture of ornamental pins, will probably furnish employment for many of the hands hitherto devoted to the production of common pins; and other arts, no doubt, connected with purposes useful and ornamental, will gradually offer to them other resources."

As an article somewhat resembling in its origin a pin's head, and perhaps suggested in the first instance by bits of the spiral coil before described, the lecturer mentioned a simple ornament, the *spangle*. The plan of making this little embellishment of dress, was long confined to the individual by whom it was invented, who made a considerable fortune by the contrivance. It would naturally be imagined that spangles are cut out of a thin plate of metal by means of a hollow punch, and the hole in the centre of each made by a solid punch: but in reality they are formed of a circular portion, or single ring of wire, which being laid upon an anvil, and struck with considerable force, is extended in all directions equally, and converted into a flat ring with a small hole in its centre, or into a spangle; at the same time that an almost perfect junction of the two extremities of the ring of wire is effected by the cohesive attraction there brought into action, as was described to occur in fixing the head of a pin.

"It may be presumed then, that no more damage will result from the application of machinery to pin making, than to those employments in which human labour is too laborious; an example of which is seen in the dreadful toil of the men who heave the coals from vessels lying in the river, into the barges alongside. Many of these men are preparing for death at the age of thirty-five; for the unnatural state in which the surface of their bodies is kept, exposes them to disease from the slightest shower, and it is not in the nature of things that life can be long supported under such circumstances. If, however, they are determined to use only the jib and pulley, and to raise the burthens by their own weight, instead of employing the whole crane, they must necessarily destroy their strength by efforts which exhaust and tear them to pieces. If, again, in the operation of pile driving, brute force were employed to work the engine, as is indeed frequently the case, the toil now sustained by human beings would be transferred to horses, and the labour of superintendence would be substituted for the labour of continually lifting an immense weight. Thus machinery may be said to have a tendency to lengthen human life; and perhaps it is not going too far, to assign the increase of machinery as one amongst the causes which have contributed to that extension of the average duration of human life, which is known to have taken place in this country since the period most remarkable for its general introduction."

The lecturer referred to two large transparencies, representing

respectively, the skeletons of a man and a horse, and gave a general explanation of the anatomical structure of each; pointing out the manner in which the muscles act upon the bones—the relative situations of the centre of gravity when the man or the horse is employed in pulling or in carrying a load;—and from the difference of structure existing between the human being and the quadruped, deducing the inference that man was not intended to be a toiling animal. “His endeavour, therefore, ought to be to diminish the efforts of the body, and increase those of the mind; and nothing can so effectually accomplish these objects as the increased employment of machinery, the effect of which will be, that his body will enjoy better health, his mind will suffer less anxiety and turmoil, and the general amelioration of his condition will follow as a natural consequence.”

[*Extractor.*

*Account of the performance of various Rail-road Carriages on the
Liverpool and Manchester Rail-way.*

(Continued from page 210.)

4. THE CYCLOPED.—*Mr. Brandreth, of Liverpool.*

THE motive power in this engine is gained in the same way as in the tread mills of prison celebrity, and the dog mills which we have sometimes heard of, only that horses, instead of men or dogs, are the agents employed. A still nearer resemblance to it may be traced in the common squirrel cage, if the reader will, but for the sake of the comparison, suppose that the squirrel drives its circular cage round by treading on the outside instead of the inside. A common wagon frame mounted on wheels is divided longitudinally into two compartments or stalls, and the bottom of each of these stalls is occupied by an endless chain of cross bars, which work into and revolve round the axles of the carriage. The horses are placed in the stalls, and by treading on the endless chains, produce the rotary motion requisite to propel themselves and the carriage forward.

The experiments made on the rail-way with this engine, did not, we believe, establish any gain, either in point of power or speed, by this new mode of applying horse power; but the apparatus was of rude construction, and can scarcely be said to have given the principle of the invention fair play. The stalls, in particular, were too narrow, and greatly cramped the action of the horses. We have no doubt that in a well constructed carriage of this description, horses might be made to work *on a rail-way* with considerably more effect than by drawing, or, at least, with equal effect and more ease. One of the principal elements of the velocity attainable on rail-ways, is the momentum which a body in motion acquires on a level or down an inclined plane; and this must often reach a point, at which any power of draught that can be applied will be not only of no use, but an actual obstruction to the velocity of the body. Suppose this

momentum should amount to a force equal to a velocity of 13 miles, *that* is a rate of velocity at which the utmost a horse can do is to move its own weight; so that were he even able to continue galloping in advance of it, he would gallop to no purpose. But suppose farther that the momentum or velocity of gravitation should exceed the speed of the horse—which as there are few horses that can travel 13 miles an hour, is a very probable case—either the horse must be run down, or the carriage compelled to stop. Now, by transferring the horse to the inside of the carriage, he will be not only removed out of the way of this momentum, but enabled to participate in the benefit of it; he will be spared all the toil of running ahead of the carriage to no purpose, and required to exert no more power than is just necessary to overcome the friction of the road, that is, to set the carriage a-going.

Any power, however, which such a carriage as “The Cycloped” might possess must always be much inferior to that obtained through the agency of steam, both in cheapness and efficiency.

5. THE PERSEVERANCE—*Mr. Burstall, Edinburgh.*

The name of this engine may be considered as commemorative of the spirit with which its ingenious inventor has persevered for several years, and under many discouraging circumstances, in his endeavours to apply steam power to the propulsion of carriages on common roads. “The Perseverance” does not differ in many material respects from the original steam carriage of Mr. Burstall, which we described at length in our fourth vol. p. 433. The chief difference is, that the boiler and furnace, instead of occupying the same carriage with the rest of the machinery, are placed on a separate carriage, attached to the hinder part of the other, and the object proposed to be gained by this alteration is, that they may be more out of the way of the passengers in the event of any explosion taking place.

Among the most valuable of the subordinate improvements may be ranked a mode of steering the front wheels, by means of a spur and an endless chain, instead of a wheel and a pinion, as in the original machine, and a provision for obtaining at will an increase of power in ascending hills.

Comparative Statement of the Performances of the Engines which competed for the Premium offered by the Directors of the Liverpool and Manchester Rail-way.

In drawing up the present comparative statement, we have left altogether out of consideration the particular competition which called forth the performances here contrasted, and have looked simply to the performances themselves without reference to any conditions or stipulations whatever. It by no means follows, that because the judges in this competition thought fit to require that each engine should run a distance of seventy miles, it is only from the performance of such a distance continuously we can form a right judgment of the capabilities of an engine, or that, because “The Rocket” was

the only engine which accomplished that distance, it is superior to every other. All that is requisite, is, that the distance should be such as to exclude the possibility of our mistaking a momentary for a permanent display of power; and a distance of twenty or thirty miles is as good for this purpose as one of sixty or seventy. The case will, perhaps, be set in a clearer light, if we substitute *time* for *distance*. No one would think of calling an hour's running at a time a mere momentary display; nor can any reason be imagined why an engine that can go fifteen, twenty, or thirty miles in one hour, should not go at the same rate for any number of hours. A steam engine is not like a horse, which becomes gradually exhausted by exertion; it is as strong and fresh at the end as at the beginning of any journey, however long that journey may be. It has its source of power in the steam generated by the boiler, and the same quantity of steam which a boiler generates at one time it must be capable of generating at any other time (the supply of water and fuel remaining always the same.) The durability of the materials of which the boiler consists, may be affected by the continuity of the process; but that is an evil which would scarcely, in any case, be felt till after the lapse of a considerable period. It is not, at least, such a drawback as would be taken into account in any experimental trial of the description contemplated by the late competition. Now, though "The Novelty," "The Rocket," and "The Sans Pareil" did not all run 70 miles each, as required by the "ordeal" of Messrs. Rastrick and Wood, they all ran uninterruptedly for more than an hour at once, and to contrast what they did in this equal and adequate space of time, is manifestly a much surer and fairer method of determining their comparative services, than to rank them according to the total distances they ran in different times.

Neither "The Cycloped" and "Perseverance" did perform for an hour continuously, and they are not, therefore, included in our comparison.

I. The first point to which we have to attend, is the respective weight of the engines, since according to their weight must be the degree of friction which they have to overcome. For the reasons we have assigned in a previous number, there must be included in this weight the whole working power of each engine, that is, the whole of the machinery and the whole of the materials necessary for putting and keeping it in motion; and, for the sake of greater clearness, we shall reduce this weight into pounds. Each engine is supposed to be fully equipped for a journey of 35 miles continuance.

Tons. Cwts. Lbs.

"The Novelty" weighed, according to the canal carrier's receipt,	-	-	-	-	-	2	15	0
Add for water in the boiler,	-	-	-	-	-	0	4	2
Water in the tank,	-	-	-	-	-	0	11	12
Coke baskets and coke	-	-	-	-	-	0	0	76

The three last items estimated by Mr. Vignoles.

lbs.
3 10 90 = 7,930

	Tons. Cwts. Lbs.		
"The Rocket," according to the official list of the carriages entered for the competition, weighed	4	3	0
The additional tender with its contents, was stated to weigh	-	-	1 13 0
			lbs. 5 16 0 = 12,992
"The Sans Pareil" weighed, according to the same official list,	-	-	4 8 0
Add for tender and its contents,	-	-	1 13 0
			6 1 0 = 13,652

From this comparison it appears, that the working power of "The Novelty" weighs little more than one-half that of either of the other engines. It must of course have to that extent less friction to overcome, and do less injury to the rails. It may be supposed that as it weighs less, it will exert proportionably less power: but this is not the case; the area of the cylinder being nearly, and the pressure on each piston precisely the same, in all the three engines.

II. We have next to consider the *quantity of fuel* consumed by each engine.

The owners of "The Novelty" professed to be able to go one trip of 35 miles with 4 bushels of coke; and what they did perform leaves no doubt on our minds that this is a fair estimate of the quantity that would be required for such a distance.

The fuel consumed by "The Rocket" in performing its two trips of 35 miles each, was stated to be about half a ton.

Of the quantity which "The Sans Pareil" consumed in going its 25 miles, we have no exact account, but we have been informed that it was nearly as much as "The Rocket" required for performing double the distance. The different construction of the boilers of the two engines furnishes a sufficient reason for believing that "The Sans Pareil" must consume a great deal more fuel than "The Rocket;" and we shall not probably err much if we assume that the difference amounts to one-fourth more.

The quantity and cost of the fuel expended by each engine per mile, will, according to these data, stand as follows:—

	PER MILE.			
	Quantity.		Cost	
	lb.	oz. dr.	about.	
The Sans Pareil (12 cwt. 2 qrs. ÷ 75)	18	10	10	2 pence.
The Rocket (10 cwt. ÷ 75)	14	14	14	3 halfpence.
The Novelty (4 bushels, or 168 lbs ÷ 35)	4	12	12	1 farthing.

The saving of expense is not the only advantage gained by reducing the expenditure of fuel; there may be situations, indeed, where fuel is so cheap as to make any saving in this respect of no moment. A matter of far greater importance is the increased facility which is thus given to the employment of steam power for the accomplishment of long distances—at sea particularly. An engine which, like "The Novelty," is worked with two-thirds less fuel than any other engine, will of course go three times the distance

with the same quantity, and have only to stop once to take in a new supply, while the others have to stop three times.

A reduction so great as has been realized in the case of "The Novelty" was never before accomplished, nor ever, we believe, supposed to be within the limits of attainment. Mr. Gurney was thought to have done wonders, when it was announced that he only consumed half a bushel of coke per mile, at an expense of twopence; but here we have a mile performed with less than the fourth of half a bushel, at an expense of only one farthing!

III. We now proceed to compare the *rate of speed* accomplished by the different engines.

"The Novelty" went on the second day of the competition, with three times its weight attached to it, $20\frac{3}{4}$ miles in one hour. The total weight moved, including the carriage, was about 15 tons. In calculating the weight in this instance, no deduction was made on account of the engine's carrying its own water and fuel, but when prepared for its intended trials on the subsequent days of the competition, due allowance was made for this circumstance. The load then assigned to it by the judges was 6 tons 2 cwt.* When it accomplished the trips recorded by Mr. Vignoles, the total weight moved, including that of a number of persons on the engine and wagons, was only 10 tons 6 cwt. 1 qr.; and the speed which it then realized was nearly equal to 22 miles an hour. It will be observed, that though some increase of velocity was thus acquired, it was by no means proportional to the reduction of the weight; a circumstance which is doubtless to be ascribed to the very imperfect working order in which the engine was at the time of this second trial. When the weight drawn was reduced to merely that of a wagon containing 45 persons—equal to about $3\frac{1}{2}$ tons—and the total weight moved to about 9 tons, the velocity was increased to 30 and 32 miles per hour; a rate which, though unprecedentedly great, is still less than what the previous performances of this engine, with double that weight, might have warranted us to expect from it.

The total weight moved by "The Rocket" when it went the 70 miles continuously, was 17 tons; and the greatest number of miles which it traversed in any one hour, was $12\frac{1}{2}$. Stripped of all weight, and carrying just as much *matériel* as would suffice for a couple of trips of a mile and a half each, it went at the rate of 30 miles an hour. Drawing a carriage loaded with passengers, it went at a velocity which sometimes reached 24 miles an hour.

The weight drawn by "The Sans Pareil," if calculated in the same way as that assigned to "The Rocket," must have been 13 tons 6 cwt. (and not 18 tons, as stated in our account of the sixth day's proceedings)—the total weight moved 17 tons 14 cwt. The greatest speed which it accomplished in one hour was $12\frac{1}{2}$ miles.

The superiority of "The Novelty" is least apparent in the instance of its drawing the least weight; but that as we have before

* In our account of the seventh day's competition we stated, that the weight assigned was 5 tons 16 cwt.; the difference arises from our omitting to include the weight of the water in the boiler.

said, must have been owing to its being in a less efficient state on that occasion. Since "The Rocket" doubled its rate of speed when it had only a carriage and passengers to draw, we can see no reason why "The Novelty" should not have done the same had its machinery continued in an unimpaired state.

AWARD OF THE PREMIUM.

Extract of a Letter from a Correspondent.

"Liverpool, 26th October, 1829.

"The prize has been at length awarded, and as you rightly conjectured in your last, to Mr. Stephenson. The directors had no alternative, since "The Rocket" was the only engine which fulfilled the conditions of the competition. There are people here, however, who think that the interests of the public would have been quite as well served, had the directors adjudged the premium on a more general view of the matter, and conferred it on that engine which is, upon the whole, "the most improved." I have seen at the Rail-way Office, the report of the judges, but cannot say that I have been at all gratified by the perusal. It is confined to a simple report of the performances of the different engines, drawn up with but little discrimination, and in some instances (as I imagine) rather ignorantly. It might have been expected of two gentlemen, who were called in to aid a body of directors with their scientific knowledge on the occasion, that they would have made it their business to point out the improvements which the competition has been the means of producing in locomotive machinery, by whom they have been effected, and to what results they lead. But there is nothing of the kind. The directors are left to cull conclusions for themselves out of the facts presented to them; and for aught that appears in the face of the report, it might be inferred that all the *novelty* is on the side of the *Rocket*, and that the *Rocket* is the only real *Sans Pareil*. I need not, however, enlarge on the merits of this document; it will, of course, be soon given to the public, and speak for itself. The directors have offered to purchase both the unsuccessful engines—unsuccessful, at least, as regards the prize; but the offer does not seem to have been viewed in the same light by their respective owners. Ackworth, who had embarked all his means in the building of "The Sans Pareil" has gladly accepted the offer; Messrs. Braithwaite and Ericsson have declined it, under an impression that it might seem their engine was bought less for its merit than on account of its misfortunes. They say they want nothing in the way of favour; and that if they can prove, as they trust to do, that their engine is better adapted to rail-way purposes than any other which has yet appeared, it will not be an order for one, or a dozen, or yet fifty engines, that will satisfy the wants of our rail-way. "The Novelty" is still here, undergoing a general repair, and is expected to exhibit again on the rail-way in the course of next week, when it will be brought to a final test, whether it can maintain, for any length of time, the extra-

ordinary speed which its partial performances during the competition displayed."

[From the Liverpool Times of October 27.]

"*The Rail-way Contest.*—On Tuesday last, the judges appointed to report on the performances of the locomotive carriages at Rainhill, gave in their report to the directors, and in consequence of the opinion expressed by them, the prize of £500 was adjudged by the directors to Mr. Robert Stephenson, of Newcastle. It has not yet been decided whether the report of the judges shall be published or not: we understand, however, that it expresses no opinion as to the principle of Messrs. Braithwaite and Ericsson's carriage, but merely gives a statement of the respective performances of the different carriages. Messrs. Braithwaite and Ericsson, the proprietors of "*The Novelty*," and Mr. Robert Stephenson, the proprietor of "*The Rocket*," are both engaged in improving and perfecting their carriages. The former is now repairing at Messrs. Fawcett's yard; and it is said that it will be tried again on the rail-way when finished. A considerable alteration has also been made in Mr. Robert Stephenson's engine, which has greatly increased its powers. It was tried again on Saturday, when it drew the enormous weight of 20 tons, at the rate of from 18 to 20 miles per hour."

FARTHER EXPERIMENTS WITH "THE NOVELTY" STEAM CARRIAGE.

Extract from a Letter from a Correspondent, dated Liverpool, December 17, 1829.

"The anxiety universally entertained by the people here to see their favourite, '*The Novelty*,' again at work, has been at length partially gratified.—Having undergone a thorough repair at Messrs. Fawcett and Co.'s factory, and been privately proved there in various ways, she made her re-appearance this morning on the rail-way under the charge of Mr. Ericsson, and has been going *the whole day* with the greatest success: no accident or interruption of any kind (as far as regards the engine) occurred. She travelled sometimes with, sometimes without passengers, and at various speeds, generally from 25 to 32 miles per hour. In several turns her rate of going averaged full 40 miles per hour! The bearings most liable to be effected by this rapid speed, namely, the crank-couplings, the eccentrics, and the axle-tree brasses, *were not once oiled*, from the time the carriage began working till the conclusion of the day's operations. Nothing can be conceived more beautifully smooth than the entire action of this carriage; all its parts worked in admirable harmony with each other. The steam appeared to be got up and kept up at the requisite pressure, with the greatest ease, and at a wonderfully small expense of fuel. The spectators, who were at one time very numerous, were much delighted, and repeatedly testified their admiration by loud cheers. But that the rail-way shares have already reached so high a premium, (about 80 per cent.!) as scarcely to admit of any further advance, I should not be surprised to see

them take another start to-morrow. 'The Rocket' has been also doing wonders in the way of speed; but the superior compactness, steadiness, and elegance of 'The Novelty,' combined with even the same speed as 'The Rocket,' would be sure to procure for it a decided preference. In order to prove *the power as well as speed* of the engine, a number of loaded wagons were attached to it; but by this time it was becoming dark, and the distance performed was not sufficient to furnish any satisfactory result. The experiments will be probably resumed to-morrow, or in a day or two after, when I shall again write you all about them."

Extract from another Letter from the same Correspondent, dated Liverpool, December 21.

"I am just returned from Rainhill, and have but time, before the departure of the post, to acquaint you briefly with the results of another long day's experiments with 'The Novelty.' It drew for several hours a gross weight of *thirty-five tons*, that is at least ten times its own weight, at the rate of *twelve miles per hour!!!* Can it now be doubted that this is as efficient an engine for weight as for speed? The superiority of the blast principle may be now considered as established beyond all doubt." [*Mechanics' Magazine.*]

On the advantage of Large Wheels in Rail-way Carriages, and the means of ascending Inclined Planes.

SIR,—The advantages derivable from the use of wheels of large diameter, seem to have been strangely neglected in all carriages used upon rail-ways, the wheels of the engines being generally less than 4 feet, and of the loaded carriages less than 3 feet diameter. To convey some notion of the amount of these advantages, I shall give the result of two experiments made by Mr. Wood, the details of which are given in his *Treatise on Rail-roads*.

A locomotive engine mounted on wheels of 3 feet diameter, drew after it 9 loaded wagons weighing 731 cwt. 36 miles in 9 hours and 35 minutes: the wheels were then removed and replaced by others of 4 feet diameter; and with this single alteration the engine drew the same load 48.8 miles in 9 hours and 27 minutes, the consumption of fuel being the same in both cases, viz. 2534lbs.: hence, as Mr. Wood observes, if the load and the consumption of fuel be the same, the space passed over in a given time will be as the diameter of the wheels, for 3 is to 4 as 36 to 48, and also *by enlarging the diameter of the wheels of the engine the velocity is increased, and the consumption of fuel diminished at the same time*: for if we suppose 36 bushels to have been consumed in each experiment, the expense per mile will be one bushel in the first experiment, and only three-quarters of a bushel in the second; whilst the velocity in the first experiment was 3.7 miles per hour, but in the second 5.15 miles per hour.

Although from the great scale on which the experiment was made,

and the time it occupied, it is decisive upon the subject: the result has certainly an air of paradox, for there appears to have been a gain of power and velocity at the same time; and as the wheels may be supposed of any diameter, it may seem to prove that the mechanical effect of a given power may be indefinitely increased, and consequently exceed the power expended; but if we examine what is the real mechanical effect in moving a carriage along a horizontal plane, the air of paradox will disappear, and it will be seen that the result of the experiment is in accordance with the laws of motion.

The resistance to the motion of wheel carriages (independent of that caused by the air) may be divided into two parts, that at the rim and that at the axles; the resistance at the rim is occasioned by the inequalities of the surface on which the carriage travels, the whole weight of the carriage requiring to be lifted through the perpendicular height of each obstacle, and of course requiring a force to be exerted equal to its own weight, moving through the same space. But in a well laid horizontal rail-way of good construction, the resistance at the rim of a perfectly circular wheel is so very small, that we may, in practice, consider the resistance at the axles as the only obstacle to the motion of the carriage.

The resistance at the axles is the friction of the wheels during their revolution on the axle, and the amount of this friction in any given time will depend upon the weight with which the carriage presses the axles; and the space through which this pressure acts, and the amount of friction overcome in any given time will be the real measure of mechanical effect in that time; therefore if the weight of the carriage be always the same, and the wheels perform the same number of revolutions in any given time, the friction or mechanical effect will always be the same, and will only require the same expense of power; but the space through which the wheels roll at each revolution on their axles will be as their diameter, and if the revolutions be made in equal times in all cases, the horizontal velocity of the carriage must also be as the diameter. Thus it will be seen that the real measure of effect in transporting carriages along a horizontal plane, is as the pressure at the axles multiplied by the number of revolutions, and not as the weight of the carriage multiplied by the space through which it passes, as would be the case if the carriage moved in a vertical instead of a horizontal path. If the plane be inclined, then in addition to the friction of the axles there is the gravitating power of the load to be considered, which will be as the weight of the carriage and the perpendicular height of the plane; and as it is only the friction at the axles which is reduced by increasing the diameter of the wheels, the increase of velocity will not be as the increase of diameter, but as the increase of diameter divided by the proportion which the friction bears to the gravitating power of the load. Thus, if it require a force of 16 cwt. to overcome the friction of a carriage on a horizontal plane, the carriage weighing 10 tons, it will require to move the same carriage up an inclined plane, 100 feet long, with a rise of 2 feet, an additional force of 10 tons moving through 2 feet, or 2 cwt. through 100 feet; and the

whole force required will be 3 cwt. through 100 feet. Moreover, as the friction is only $\frac{1}{5}$ of the whole resistance, the increased velocity obtained from increasing the diameter of the wheels is only $\frac{1}{5}$ of what it would be on a horizontal plane.

Another advantage which large wheels possess over small ones is, that they are less liable to slip or turn round on the rails without advancing the carriage; and this advantage Mr. Wood has wholly overlooked, for in his experiments to ascertain the amount of adhesion of the wheels to the rails, he states it to be $\frac{1}{25}$ of the weight of the engine, without adverting to the size of the wheels. Now the adhesion evidently depends upon the weight of the carriage and the diameter of the wheels jointly, for the force with which the circumference of the wheel is pressed by the carriage against the rail, may be considered as a weight acting at the end of a lever, whose length is the radius of the wheel, and the resistance will be as the radius is to the length of the crank by which the wheel is turned: or, as the amount of friction is as the pressure and as the space through which it acts, the friction of the wheel in slipping during any portion of a revolution will be as the diameter of the wheel; therefore the *weight* of the engine may be diminished or the weight of the load to be drawn may be augmented, if the diameter of the wheels be increased, provided the *power* of the engine bear always the same proportion to the load.

The superiority of large wheels over small ones being so evident, I have no doubt that in future attempts at improvements on locomotive engines, greater attention will be paid to this point, and that the diameters will be increased as far as is consistent with strength, and without adding too much to the weight; and the limits in this case will, I think, be best attained by wheels on Mr. T. Jones's construction, which may now be had formed entirely of wrought iron, and which far exceed in lightness and strength any wheels hitherto employed on rail-ways. What these limits may be is hard to say, but it seems not too much to expect that wheels of 8 or 9 feet diameter may be employed; for the wheels of timber wagons and also of the French diligences are frequently 6 feet in diameter, although made of wood, and exposed to great transverse strains from the inequalities of the road. Eight feet, therefore, does not seem to me too great a diameter for iron wheels upon a rail-way, and exposed to no transverse strain; and the stability might be rendered even greater than at present, as the diameter would admit of the boiler and the rest of the apparatus being placed below instead of above the axles.

There is another point to which I would advert, viz. the means of ascending a plane, the acclivity of which is too great to be overcome by the adhesion of the wheels: in this case the carriages are in general hauled up by a rope wound round a barrel turned by a fixed steam engine; but the friction of the rope along the plane, although supported by friction rollers, amounts in many cases to nearly one-third of the whole resistance, whilst in most cases the ascent might be surmounted by either of the following methods:—1st. By means

of a toothed rail along the whole length of the inclined plane, into which a toothed wheel attached to the locomotive engine works, as on the Middleton Colliery Rail-way at Leeds. Or, 2nd, by means of a chain extending the whole length of the plane, and made fast at each extremity, and a spike wheel attached to the locomotive working into the links of the chains: for this method Mr. Chapman has a patent, if it be not expired. By either of these methods the friction before mentioned would be avoided, and fixed engines be unnecessary, which would be a great advantage, especially if rail-ways should ever be laid by the side of turnpike roads.

If you can spare a space in the "Mechanics' Magazine" for the insertion of these suggestions,

You will much oblige your most obedient servant,

J. MURDOCH:

[*lb.*]

On preventing the Warping of small Files in Hardening.

SIR,—Your correspondent "C. C." wishes to be made acquainted with "the method which file makers adopt to prevent the warping of their small files in hardening." To satisfy his inquiries, I send you a few hints; and should "C. C." find them useful, and make the result of his experiment known through the medium of your valuable work, he will by so doing "confer an obligation" on me; as I am of the opinion, and perfectly agree with your correspondent, Mr. Mackinnon, who justly observes, that to be master of the above art "requires experience, and cannot be taught by written directions."

First, forge your steel plates to the size required, after which they must be softened, thus:—take a quantity of wood chips, and having heated your plates hot enough to set them on fire, let them be placed thereon, and remain there until the whole of the chips are consumed, and the plates cool. Your plates must now be filed perfectly level for cutting; and the same method must be resorted to in files which require to be re-cut. When they are cut, they should be placed in a mixture of lime and water, of moderate thickness, in which they may remain for any length of time, or till you wish to harden them; they will not rust, or take any hurt, by lying in this solution, the lime being a preventive.

When you feel inclined to harden them, they must be taken out of the mixture, and placed directly before a good fire, to dry the lime, which will fill up the cavity between the teeth, and is only used to prevent the fire from destroying the same during the process of hardening. You must now have in readiness a tub, containing three pailsful of spring water, into which you may place the following ingredients:—

8 oz. of sal-ammoniac, powdered;

8 oz. of aqua-fortis;

1 lb. of common salt;

which water may be kept for hardening some time. You must also have at hand a wooden mallet and block, in case of your file coming in contact with a piece of coke, &c. while getting your heat, and causing the same to bend; in which case you must lay your file upon the block, and gently press the crooked part with the mallet until you have made it perfectly straight. It is farther necessary to have a flat box, containing 1 lb. of common salt, in which you must rub your file every time you take it out of the fire to ascertain your heat. Having all these requisites prepared, then blow up a good loose fire, free from gas or green coal; and when you have got a good red heat, hold your file as perpendicularly as you possibly can over the water; and sink it gradually, in the like position, into the same as far as the tang, or handle, which must not be hardened.

By this process you are likely to harden many files at the first attempt; yet sometimes you cannot prevent some from warping. If any of them should do so, they can be remedied thus:—put a quantity of grease or oil into a long flat pan, into which place the files which are warped; then heat a piece of iron red hot, which place in a vice, and take one of the warped files out of the oil pan, and fasten a hand vice at each end to hold it by; then humour the same backwards and forwards, according to the warping, which will presently come straight, taking care to keep plenty of oil upon your file, which preserves the temper of the steel, and prevents the heat of the iron from softening it. This done, nothing remains to be observed but cleaning.

Place your files into a pail of warm water; then take a hard brush, on which place a little soap, and brush them till all the lime which still remains between the teeth is completely washed out; then place them directly before a good fire to dry, and brush them again with a dry brush. Finally, take a small quantity of the best oil, and drop a little on a soft brush, and rub them all over with the same, taking care to let the files be a little warm, which will cause the oil to spread more thinly over them. They are now in a fit state to be laid by till wanted for use.

This, sir, is all the information I can give your correspondent respecting this matter. But, before I conclude, I should advise him to forge out a few pieces of steel to the dimensions required, and let him practise hardening the same, till he is somewhat perfect; by which means he will save a quantity of files which he might otherwise spoil.

R. DANIEL.

[*1b.*]

On the Precautions which ought to be taken in the Preparation and Use of the various inventions for producing Instantaneous Light.

[From De Moleon's *Recueil Industriel*, with additions by Thos. Gill, Esq.]

“THE first apparatus of this kind, were the *phosphorus bottles*; and, for a long time, they were only prepared by the makers of phi-

losophical instruments. They were made by introducing a certain quantity of phosphorus into small bottles, which were then placed upon a sand bath, and when the phosphorus was melted, they repeatedly plunged into them a red hot iron; by this means a portion of the phosphorus became oxidized, and the mixture which resulted from the operation, possessed the property of inflaming, when brought into contact with the air. To light a sulphured match, it was sufficient to open or unstop the bottle, to plunge the match into it, and to rub off or detach a small portion of the phosphorus; and, upon withdrawing it from the bottle, the match was kindled. This contrivance, however, had the inconvenience of the phosphorus powerfully attracting the humidity contained in the air; so that in the space of a short time, and unless the bottle was instantly carefully closed by a well fitted ground stopper, it lost its effect."

The Editor prepared these phosphoric bottles many years since, and found that a white saline efflorescence had formed itself, and covered the surface of the phosphorus; and, upon taking a little of it up, on the point of a match, and bringing it into contact with moisture, it instantly took fire, with a sudden flash of light.

"To these phosphorus bottles, the preparations known under the name of *Inflammable Mastic* succeeded, the first of which was invented by the baron Cagnaird Delatour. This preparation was free from the inconvenience of attracting the humidity of the air, and would last until the matter inclosed in the bottles was completely exhausted. This matter was phosphorus, in a particular state of combination, and which could not be imitated by any other manufacturers. But the price of it was too high, and others, therefore, endeavoured to make compositions possessed of similar properties, but at lower prices. In order to this, they mixed phosphorus with magnesia, and other earthy matters, but they did not possess the good qualities of the above mentioned ones; as they would only act for a short time, and became quickly spoiled."

The Editor recollects a composition of this kind being made by a chemical friend of his in London, and which was possessed of the above valuable property. The specimen he saw was inclosed in a bottle; and had a brown colour, and also smelled strongly of camphor; on a little of it being taken up on the point of a match, and brought in contact with the air, it quickly caught fire. The preparation of it was, however, kept secret.

"The *phosphoric bougies* were invented about this period. They consisted of slender glass tubes hermetically closed, of about the eighth of an inch in diameter, and four inches long; and they contained a cotton wick, dipped in white wax, and secured into one end of the tube; the other end of the cotton wick being placed in contact with a small portion of phosphorus, which, no doubt, had been oxidized by the method indicated at the beginning of this article; and, upon breaking the tube across, at a place marked by a small band of paper, cemented around the tube, at the end opposite to that containing the phosphorus, and drawing out the cotton wick, the phosphorus upon it instantly caught fire. These continued in use for a considerable period, but they had also the misfortune of being too dear.

“To these succeeded leaden bottles, each containing a piece of solid phosphorus, and closed with corks. Upon taking up a little of this phosphorus on the point of a sulphuretted match, and rubbing it backwards and forwards a few times upon a piece of cork or felt, the sulphur on the match combined with a little of the phosphorus, and kindled from the heat occasioned by the friction.”

These leaden phosphorus bottles are now commonly sold about the streets of London. They have the inconvenience, however, of the mass of phosphorus being exceedingly liable to take fire, and thus to do mischief; and they also then become useless, until the phosphorus is replaced.

The Editor well recollects his friend Mr. J. T. Cooper, Lecturer on Chemistry applied to the Arts, several years since preparing matches tipped with sulphur and phosphorus; and which quickly ignited, when rubbed upon a piece of cork. Possibly the common sulphured matches may be rendered capable of quickly igniting in this manner, by merely rubbing their points upon a stick of phosphorus, placed in a shallow vessel of water, to prevent it from taking fire from the friction. The matches ought to be prepared, however, shortly previous to using them, and before the phosphorus is become decomposed; and they should likewise be kept in boxes, or close stopped bottles, and be thus secured from any danger of igniting by accidental friction.

The Volta's Lamp, in which the jet of hydrogen gas is kindled by an electric spark, may be justly added to these instantaneous methods of procuring fire and light; and so also may be the fire cane, and the still more portable instruments of a similar kind, as the fire tubes, &c. for igniting German tinder, by means of strongly and rapidly compressed air.

“The modern chemists having discovered that the chlorate of potash causes combustible bodies to burn more rapidly than nitre; thought of applying it to the preparation of gun powder, and the first experiment which was made at Essone, cost the lives of the workmen; because they were ignorant that it would inflame, unless by the sparks produced by the contact of flint and steel, or by bringing it into contact with a burning body. Whereas, simple percussion, or the friction produced between two hard substances, was sufficient to inflame it with detonation! In consequence, the preparation of these mixtures was exclusively confined to the laboratories of the chemists, and designated in their writings, by the name of fulminating powders.

“But as it was also known, that this combination had, amongst other qualities, the property of inflaming, by simple contact with the concentrated sulphuric acid; so they were not long in bringing this property into use, and which offered great advantages in kindling, what are now termed, the *oxygenated matches*.

“It is convenient to divide the manufacture of these oxygenated matches into two parts. The first, consists in palpably pulverizing the chlorate of potash, and intimately mixing the powder with flour of sulphur. But, as we have before mentioned, a similar mix-

ture violently detonates by percussion, or merely by the simple friction between two hard bodies, such as the pestle and mortar, or the muller and grinding stone. The accident at Essone was not the only one of the kind. Mr. Rochette, jun. an optician, residing at Paris, and who was one of the first persons who manufactured the oxygenated matches for sale, lost his life from a detonation, occasioned by preparing this mixture for use; and a loss was besides sustained, amounting to more than 1200 francs.

“Another druggist of Paris, also lost a young man, owing to a similar accident; and we could mention many others. And, indeed, in two particular instances, the quantities of the mixture operated upon, amounted only to a few ounces in weight. But now-a-days, and in consequence of the great consumption made of these oxygenated matches, we cannot too much recommend the proper authorities to superintend the manufacturers, who prepare many pounds of this mixture daily, and to oblige them to remove their workshops to a distance from any habitation; and also to make a law, to prevent them from mixing the composition with gum arabic. It is in vain, they say, that the detonating mixture is modified, and that they have diminished the proportion of chlorate of potash, by substituting nitre in place of it. As it is a fact, that this new mixture is not less detonating than the former one!

“The second part of the manufacture of these oxygenated matches, consists in making a thick fulminating mixture of the chlorate of potash, sulphur, and nitre, by tempering them with a sufficient quantity of a weak solution of gum arabic in water. Sometimes the manufacturers add a little vermilion to the mixture, to colour it red; but they frequently leave it of its natural colour, which is a pale yellow. It is sufficient to plunge the extremity of the match into one of these thick mixtures, to the depth of about the eighth of an inch, and to leave it to become dry. The matches are similar to the common ones, except that they are only sulphured at one end, and are made of double the thickness.

“This second part of the manufacture presents no danger, and may, therefore, be permitted, without inconvenience, to be carried on in Paris. It is even advantageous, as it employs young children, and removes them out of the way of contracting those vicious habits, which idleness generally brings upon the poorer classes of people.

“To make use of these oxygenated matches, it is sufficient to plunge the prepared end of one of them into a small bottle containing asbestos, imbibed with concentrated sulphuric acid, and instantly to withdraw it. The sulphuric acid acts upon the deslagrating matter, and inflames it, as well as the sulphur, and thus kindles the match. These matches have no other inconvenience than that of burning small holes in the clothes of those persons who are in the habit of using them.

“The detonating or fulminating matches, are those, which after being lighted by any means, at a certain period of their burning, make an explosion. These matches are more costly than the others; and, consequently, are only purchased by persons who know what

they require. At present, they are only sold by the dealers in objects of philosophical amusement. The preparation of these matches is simple: it consists in making, by means of a small gouge, an excavation in the stem of the match, at about a third part of its length, from the prepared end of it; and raising up the loosened part of the wood, introducing into the hole, made at the farther end, an atom, either of fulminating silver, or fulminating mercury, but especially the former; and then glueing up fast the small slice of wood raised by the gouge.

“These detonating matches present no danger, but only to the persons preparing them, and even that danger is not great; as with a *gros* weight only of the fulminating material, they may prepare many hundred matches; and the consumption of these being limited, the manufacturers consequently never keep any considerable quantity of the fulminating matters by them. We, therefore, think, that the manufacture of these detonating matches may, without inconvenience, be permitted in the city. It is always easy to distinguish these detonating matches from others. It is sufficient to examine them; and we may always perceive a part upon their stems which shines, and indicates the place into which the fulminating material has been introduced, and finally glued over. Nevertheless, we should wish that persons would cease to make use of this kind of sport, which, in many circumstances, is not without danger; owing to the fright which they occasion, and to females in particular, when they are thus taken by surprise.”

We find an instantaneous light, lately described in *The Quarterly Journal*; and which is evidently formed by the application of detonating silver, or fulminating mercury, to the surface of the wood at the end of a match. It is thus described: “Instantaneous Light.—Amongst the different methods invented in latter times, for obtaining a light instantly, ought certainly to be recorded that of a chemist, at Stockton upon Tees. He supplies the purchaser with prepared matches, which are put up in tin boxes, but are not liable to change in the atmosphere; and also with a piece of fine glass paper, folded in two. Even a strong blow will not inflame these matches, because of the softness of the wood underneath; nor does rubbing upon wood or any common substance, produce any effect, except that of spoiling the match. But when one is pinched between the folds of the glass paper, and suddenly drawn out, it is instantly inflamed.” Now we well know that detonating silver will readily explode by the friction of glass paper, and is accordingly employed in many various ways, as in the laces, tapes, or girths of security, against house breakers, &c. &c.; and therefore these new instantaneous lights are no doubt formed, by its application to the points of these soft wood matches, and most probably in mixture with camphor, resin, sulphur, or other inflammable materials. Care ought, however, to be taken in their use, lest, by falling upon a sanded floor, and being accidentally trod upon, they may take fire, and thus do great mischief!

We well recollect serious accidents having been occasioned, by

the chemists who first prepared the fulminating silver here, not being fully aware of its nature; and, in particular, Mr. J. T. Cooper, losing his eye sight for a considerable time, owing to a portion of it, even whilst still wet, exploding, in a Wedgewood's evaporating basin, merely by his touching it with a steel spatula; it also fractured many glass vessels, and several panes of the windows; and even drove pieces of the basin into the wooden table, upon which he was at work: too much care cannot, therefore, be taken in employing this dangerous substance.

We have lately had another instantaneous light apparatus introduced under the name of the Prometheans. These are small glass bulbs, or tubes, filled with concentrated sulphuric acid, hermetically sealed, and surrounded with a mixture of inflammable materials, amongst which the chlorate of potash forms one; and the whole being again inclosed or surrounded with paper, also rendered still more inflammable by means of resinous matters. Upon pinching the end containing the glass bulb, or tube, it breaks, and the sulphuric acid instantly kindles the surrounding materials. These Prometheans are, however, expensive; and require that care be taken that the sulphuric acid, &c. do not come into contact with furniture, clothes, &c. The chief merit of this contrivance lies in securing the sulphuric acid from all danger of imbibing the moisture of the air, which is the great cause of the speedy failure of the acid bottles employed in kindling the oxygenated matches. These Prometheans are patented by the manufacturer of them.*

We have now also to add to these numerous means of procuring instantaneous light, Dobereiner's discovery of the igniting action of a jet of hydrogen gas; when thrown upon a mass of the spongy platina, and which is now employed in a variety of ways, perhaps in none more successfully, than in the apparatus invented by Mr. Jackson, surgeon, and which obtained the approbation and reward of the Society of Arts, &c. &c.

The kindling of *amadou*, or German tinder, by the sparks produced from the collision of a flint and steel, now so very commonly used here in lighting segars, ought also to be included amongst the methods for producing instantaneous light. The Editor, many years since, improved upon this apparatus, by substituting for the German tinder, a loosely twisted cotton cord, steeped in a solution of pure nitrate of potash, and which readily kindled by the sparks produced from the flint and steel. He did not, however, content himself with merely igniting the cord, and which required the use of a sulphured match to obtain a light from it; but he also prepared the cord, by coating portions of it at regular intervals, alternately with sulphur, and with wax; the sulphur readily kindled of course, by the ignited match cord, and as readily lighted the wax; and thus a flame was produced, by one operation only. This flame endured sufficiently long to seal a letter, and for many other purposes; and might even

* They are the invention of Mr. Isaiah Jennings, of New York. [EDITOR.
VOL. V.—No. 4.—APRIL, 1830.

be prolonged, by thus preparing the wicks of wax bougies or candles of a greater length and thickness, with nitre and sulphur.

[*Technological Repository.*]

On the Uses of Steatite; and particularly in the Lubrication of Machinery to reduce Friction.

[From De Moleon's *Recueil Industriel.*]

STEATITE is a kind of saponaceous stone, which is sometimes found of a white colour, at others gray or green, and but rarely red or yellow. Its specific gravity varies from 2.60 to 2.66.

This substance is composed of a mixture of silex, alumine, magnesia, oxide of iron, and water; but it differs according to the localities in which it is found. It is very common in Germany, and in Cornwall; and we have no doubt that it may also be found in the western parts of France.

As steatite is not fusible excepting at a very high temperature, and as it can be worked with the greatest facility, so it forms excellent crucibles, which harden in the fire, and which litharge penetrates with great difficulty. It also serves as a facing to protect moulds for casting iron, and other metals.

M. Viscot, of Liege, made a great number of experiments to prove that this substance might be employed by the lapidaries. He formed cameos with it, to which he gave a fine polish, after exposing it to the action of the fire; and it becomes so hard, as to give sparks like flint, when struck upon hardened steel.

By polishing it, he gave the appearance of agate, and even obtained some pieces, which perfectly resembled the onyx; but this appearance was quickly destroyed by the fire, and he found it impossible to restore it.

Having a great affinity with glass, the steatite, when reduced to a very fine powder, and mixed with the colours, becomes exceedingly convenient in painting upon it. It is also used as a kind of sympathetic crayon, for drawing or writing with upon glass, and on which it leaves no apparent trace, after the drawing or writing has been wiped over with a woollen cloth. However, the marks are rendered instantly visible, by breathing upon them; but they disappear anew, when the glass becomes dry.

The embroiderers and tailors prefer steatite to chalk, to make traces with; as they are more durable, and do not affect the colours of their cloth.

As steatite has the property of combining with oil or grease, so it enters into the composition of the greater part of the balls, which are used for cleaning silks and woollen cloths from oil or grease spots. It also serves as a basis, in the preparation of certain colours for painting with.

It is employed to give a fine polish to marble, serpentine, and other gypseous stones. Mixed with oil, it is used to polish glass and metallic mirrors.

If the surface of newly prepared leather be sprinkled over with it; and if, when it has become dry, it be rubbed with a piece of horn, it will give the leather a fine gloss.

Steatite is also employed to glaze paper, upon the surface of which it is sprinkled, when it is reduced to a very fine powder; or, which is much better, when mixed with the colouring materials. To glaze the paper, it must be rubbed over with a hard brush.

The powder of steatite, owing to its unctuousity, is one of the substances employed in lessening the friction of screws, toothed wheels, and other metallic contacts.

Steatite is a mineral, which belongs to the primary or secondary formations. It often constitutes beds of great extent, but when pure, it usually forms lumps of greater or less magnitude. That variety of it, termed Venice talc, abounds in the Tyrol and the Valteline. The Briancon and the Spanish chalks are found, the one in the Alps of Dauphiny, near Briancon; and the other in the mountains of Aragon. The Venice talc affords a powder, which renders the skin smooth and shining, and is employed as a cosmetic. The lard stone is also another kind of graphic talc, and is used in China, to form small grotesque figures.

Fat, and fixed oils, have long been used to lessen friction in machinery. But the bad properties, and the ill scents of these matters, ought to induce us to abandon their employment, and to substitute others for them. And we may likewise add, that the emanations which they diffuse in the workshops or mills, are frequently inconvenient; and it would, therefore, be much better to sell them to the manufacturers of oil gas. Plumbago, or the carburet of iron, has been successfully used for diminishing friction in machinery; but this material is too rare and costly to be ordinarily used. There are, however, other unctuous minerals to which we may recur, and amongst these, steatite seems to hold the first rank.

The citizens of the United States of North America, who cultivate with success the employment of machinery, as we may judge from their numerous steam boats and other machines, both for naval and other purposes, appear to be the first persons who have employed steatite in the large way. It is not, however, used alone, but mixed with a small quantity of oil, suet, or tar. They commence by reducing it to a very fine powder, and then mixing or triturating it with the material intended to render it more unctuous. The first experiments on using it were made at Lowell, in the state of Massachusetts; and the coachmen and wagoners have found it highly beneficial.

Mr. Moody, superintendent of the great iron works established upon the mill dam, near Boston, has afforded us means of estimating the advantage to be derived from the use of this new mixture. In one of the works is a wheel of great size and weight, which makes from 75 to 100 revolutions per minute, and turns upon necks or gudgeons of five inches in diameter. It has moved with this speed during three, and sometimes five, weeks together, without renewing the lubrication of the gudgeons. Nevertheless, Mr. Moody thinks

it best to renew it oftener. The machinery, of which this great wheel forms a part, manufactures about 200,000 pounds of iron per month.

It is to chance, that we are indebted for the discovery of this valuable employment of steatite, the use of which is now continually extending in the United States; and will also, no doubt, be speedily adopted in Europe.

Additions by the Editor of the Technological Repository.—Steatite is also used in the United States to line furnaces with; a type founding machine, sent from thence, and patented here, had a furnace of this kind. And the Editor lately saw, in the hands of Mr. Lemuel Wellman Wright, engineer, a cubic mass of it, a foot square, and which had been sent to him by an American friend. He had sawn off a portion of this block, and exposed it to the heat of his fire for several hours; after which, it had assumed the appearance of a mass of *mica*, still, however, cohering together. The Chinese also make small portable furnaces of steatite.

The *lapis ollaris*, or potstone, is also another variety of steatite. Bishop Burnet gives the following account, in his travels, of the mode of using it in Switzerland. “There are a sort of pots, made of stone, which are used, not only in all the kitchens here, but also in those of almost all Lombardy, called *Lavege*. The stone feels oily and scaly, so that a scale adheres to the finger of any one that touches it, and it is somewhat of the nature of slate. There are but three mines of it known in these parts; one near Chavennes; another, in the Valteline; and the third in the Grisons; but the first is much the best. They generally cut it round in the mine, in masses of about a foot and a half in diameter, and a foot and a quarter in thickness; and they work it into shape in a mill, where the blocks of stone are driven about by a wheel, set a going by water; and which is so ordered, that he who manages it, turns the outside of the stone, first, till it is quite smooth; and then separates one pot after another, by small and hooked chisels, by which means he makes a nest of pots, one within another; the outward and biggest one, being as large as an ordinary cooking pot, and the inward one, no larger than a common pipkin. These pots they arm with hooks and circles of brass; and so they are used by them in their kitchens. One of these pots heats and boils sooner than any metal pot; and yet the bottom is twice as thick as that of a metal one. It never cracks by the heat, nor gives any sort of taste to the liquor that is boiled in it; but if it falls to the ground, it breaks, as it is very brittle; nevertheless, it is soon repaired again; for they piece their broken pots so close, by sewing the broken parts together with iron wire, which completely fills the holes they make to receive it, that there is no breach made, although no cement is used. The passage to the mine is very inconvenient, for they must creep for near half a mile through a rock, which is so hard, that the passage is made not above three feet high; and so that those who draw out the stones, creep all along upon their belly, having a candle fastened to their forehead, and the stone laid

upon a sort of cushion, made for it upon their hips. The stones are commonly two hundred weight." [Ib.]

On Purifying Linseed and Rape Oils. By Mr. THOMAS COGAN.*

Of the seed oils, those which are in the greatest demand are from rapeseed and linseed. In France, and in most other parts of continental Europe, rapeseed oil is that which is generally used for lamps; but it will not give a clear light till it has been freed from the mucilage and other matters, which, when heated, become charred, and thus load the wick, and by obstructing the capillary action, impair the free supply of oil. Acids, properly applied, will precipitate the mucilage; but long subsidence, or tedious filtration, are necessary for this purpose; and after all, the oil is found still to retain some acid, or at least its properties have undergone some change, which diminishes its inflammability.

Linseed oil is not made use of in lamps, but there is an immense consumption of it, as the basis of oil paints, both of those that are used in house painting within doors, and of those that are employed by the artist. Linseed contains so much mucilage, that it is necessary to roast the seed, more or less, in order to enable it to give out its oil to the action of the press; and on this account the oil, which naturally has only a pale yellow colour, is generally reddish brown, from the previous roasting of the seeds, and still contains also a considerable proportion of mucilage. By separating from the oil this scorched mucilage, it is much improved as a vehicle for white and pale colours, and is also better able to resist the action of air and weather.

M. Thénard was, it appears, the first who published a method of freeing seed oils from their mucilage, by the action of sulphuric acid; but the subsequent separation of the charred matter, by long standing, or by slow filtration, was a great objection to the process; and the attempt to wash out the remains of the acid, by mechanical agitation of the oil with water, either cold or warm, was far from being fully successful.

Mr. Cogan's process, though resembling M. Thénard's in the first part of it, is completed by the judicious introduction of steam; by means of which the oil appears to be almost entirely freed from acid, and the black feculent dregs subside in the course of twelve hours, leaving the supernatant oil quite clear, and greatly improved in colour, and in those qualities for which it is valued by the painter.

The quantity that he operates at once is about 100 gallons. For this, three quarts, that is, about ten pounds of sulphuric acid (oil of vitriol) is required. The acid is to be diluted with an equal bulk of water. The oil being put into a copper pan, of the shape of a

* From vol. XLVI, of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce, just published. The Society voted its silver Isis medal, and ten guineas, to Mr. Cogan, for his discovery.

boiler, two quarts of the dilute acid are to be added; the whole is then stirred up very carefully for an hour or more with a wooden scoop, till the acid has become completely incorporated with the oil, and the colour of this last has become much deeper than at first. A second similar quantity of acid is then to be added, and mixed with the oil in the same way as the first was; and after this, the remaining third part is to be added. The stirring of the oil is to continue incessantly for about six hours in the whole, at the end of which time the colour of the mixture will be almost that of tar. It is then to be allowed to stand quiet for a night, and in the morning is to be transferred to the boiler; this is of copper, and has a steam pipe entering it at the bottom, and then dividing into three or four branches, each of which terminates in a perforated plate. The steam, thus thrown in, passes in a very divided state into the oil, penetrates into every part of it, and heats it to the temperature of boiling water. The steaming process is to be continued for about six or seven hours, when the oil, &c. is to be transferred to a cooler, of the form of an inverted cone, terminating in a short pipe, commanded by a stop cock inserted in its side, a few inches from the bottom. After remaining a night in the cooler, the oil is fit to be withdrawn; for this purpose the cock at the bottom is opened, and the black watery acid-liquor flows out. As soon as the oil begins to come, the cock is closed, and that in the side of the cooler is opened. From this the oil runs quite clear and limpid, the whole of that which is still turbid remaining below the upper cock. The purified oil being drawn out, that which is turbid is let out into a reservoir, where it either remains to clarify by subsidence, or is mixed with the next portion of raw oil.

*On the so termed Chinese Rice Paper.**

THIS article is imported into this country in considerable quantity, and is employed as a material for artificial flowers, and for other ornamental purposes. Its common name shows the popular opinion respecting its origin. The subjoined extract from a letter by John Reeves, Esq. of Canton, a member of the Society of Arts, proves, however, that the rice paper is not a manufactured article, but an unchanged vegetable production, cut spirally, and afterwards flattened by pressure.

Canton, March 7, 1826.

SIR,—My son will soon forward to you a sheet of the substance, called in England “rice paper,” and the piece of the plant (or I should rather say, of the branch of the plant) from which it is made; but whether this is a tree or shrub I cannot at present discover, as the person from whom I had my information, had only seen the mode of cutting and using the plant.

The branches being cut into lengths of the intended, or usual breadth of the sheet of rice paper, are placed upon a thick piece of

* From vol. XLVI, of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

copper, with two raised edges, as guides to keep them steady; and being held in the left hand, are presented to the edge of a large knife, about ten inches long, and three inches broad, made very sharp, and held in the right hand.

A slight incision being made in the piece of branch for its whole length, it is kept moving round by the left hand, while the knife is also kept in motion by the right hand, and is thus sliced or pared down from circumference to centre, and then spread out to flatten.

The sheets are usually made up into bundles, of nineteen or twenty pieces each, which weigh about twenty-three ounces, and are sold wholesale, for about one dollar a bundle.

The refuse pieces, such as that sent you, are used for making artificial flowers.

It is chiefly brought from the island of Formosa, by the Chinese junks; hence is the difficulty of ascertaining the nature of the plant; as few, if any, of the persons concerned in the sale of the prepared article at Canton, have ever seen from what it is made.

I am, sir, &c. &c.

J. REEVES.

Remarks by the Editor of the Technological Repository.—We have long been of opinion, from microscopic observations, that the so termed "Chinese rice paper," was an organized vegetable production, much resembling in its structure *the pith of elder*; and our opinion is now fully confirmed by Mr. Reeves's letter.

It appears to us, that the two raised edges upon the sides of the piece of copper, serve not only as guides to keep the pith steady, but also to regulate the thickness of the slices; the knife lying upon their tops, and the piece of pith being held down upon the bottom of the plate of copper, and gradually turned round and presented to the edge of the knife, whilst it is carried along backwards and forwards; the slice cut will pass underneath the knife, and escape at the front of the plate, and be succeeded in its turn by the remainder of the slice, until the operation is finished.

We have no doubt that cylindrical pieces, either of elder or other pith, might be found in this country, quite large enough to bear slicing in this manner; and which slices, after being flattened by pressure between plates, (possibly warmed or heated) might serve as substitutes for those of China, and be equally capable of receiving any colours. We now see beautiful figures cut-out of elder pith, by a skilful hand, exposed for sale in most of our philosophical instrument maker's shops, for electrical experiments, and hope soon to see leaves of it formed in the same manner:

On the Colouration of Golden Articles of Jewellery. By M. CASTELLANI.

[From the Bull. Univ.]

THE two best mixtures, according to M. Castellani, for the purpose of giving a good gold colour to articles of jewellery, are as follows:—

Muriatic acid at 22°,	-	-	-	-	10 parts.
Oil of vitriol,	-	-	-	-	4
Crystallized boracic acid,	-	-	-	-	2
Water,	-	-	-	-	150
Or,					
Acid muriate of alumina (liquid,)	-	-	-	-	13
Crystallized sulphate of soda,	-	-	-	-	4
Crystallized boracic acid,	-	-	-	-	3
Water,	-	-	-	-	150

Either of these mixtures, with twenty grains of neutral muriate of gold, constitutes the bath, which is to be used in the following manner:—A large glass matrass, carefully luted at the bottom, is placed over a circular furnace, so as to have heat readily applied to it; the solution is to be put into it, and when at the boiling point, the pieces of jewellery, previously cleaned and picked, are to be introduced; suspended upon golden wires. After a few minutes, a copper wire is to be immersed, and left until the gold has acquired a deep colour; it is then to be withdrawn, but the articles still left in until they have acquired the colour necessary. They are then to be put into warm water, acidulated by sulphuric or acetic acid, to remove particles of oxide of copper, washed in clean warm water, and dried near a fire.

Generally, a single operation is not enough; for, as a long immersion produces harm from the oxide of copper, it is better to shorten it, and repeat the operation. The colour produced by several immersions is always the best; that by one long immersion is red, and often requires the articles to be entirely cleaned and recoloured.

The mixtures above have been used for golden articles containing one-fourth of copper; other alloys would probably require other proportions. When the articles are large and thick, the immersion should be longer than for small, thin, or narrow ones. As the bath is good in proportion to the gold it contains, when, by successive colourations, that has been removed, a few drops of muriate of gold should be added, and sometimes portions of the other constituents and of water. The copper wire is oxidized in the process, and sometimes covered with a film of gold, in which case it should be changed or cleaned. If an intense yellow colour is required, the immersion should be frequently repeated, and the copper brought into contact. If a pale colour is required, the last immersion should be at the boiling point, and the copper wire ought not to touch.

Bronze articles, gilt by amalgamation, may be coloured in the same way; but M. Castellani has not as yet determined the best mixture for the bath.

Machine for beating and hackling Hemp and Flax. By M. LORILLARD.

THE machine invented by M. Lorillard for beating and hackling hemp and flax consists of a balance of a triangular form, having its obtuse angle reversed and furnished with an axis turning on supports,

so that the two small sides of the triangle may take alternately, the one a horizontal position, and the other the inclination of 45 degrees. These two sides are furnished beneath with blades, arranged some parallel and others oblique to one another; and these blades take between others fixed on a horizontal strong piece of wood, in the direction of the balance beater, and which is supported by a wooden frame. The workman acting on a lever attached to the extremity of the balance, makes the beater descend alternately, by a vibrating motion; by this means it breaks the hemp and flax, which another workman places on the lower blades. The substance thus beaten twice over, first between the parallel blades and afterward between the oblique ones, is stript of its woolly substance (*sa chenevotte*.) It is afterward submitted to the action of an apparatus composed of two plates of wood grooved in the same direction, between which it undergoes a friction which deprives it of its resinous gum. It comes out of this apparatus in a state of perfect softness to be afterward passed through combs or hackles of different degrees of fineness, arranged for that purpose on the frame of the machine.

[*Bull. de la Soc. d'Encouragement.*

The history of the invention and improvement of Achromatic Telescopes.

ONE of the finest discoveries of the eighteenth century, is that of the *achromatic telescope*; and, if we owe to those founded on the principle of reflection, the great discoveries of sidereal astronomy, it is by means of the achromatic telescope, as applied to transit instruments and divided circles, that the nicest measurements of celestial arcs have been taken, and those accurate results obtained which have led to the completion of astronomical theories, and to the perfection of the lunar and planetary tables.

After the penetrating genius of Sir Isaac Newton had pronounced the improvement of refracting telescopes to be despaired of, no slight honour must belong to the individual who dared to hope where Newton had desponded, and who triumphed over the difficulties which baffled the theoretical and practical skill of the high priest of nature. This fortunate individual was Mr. Chester More Hall, of More-Hall in Essex, a name scarcely yet embalmed among the sacred relics of science. In imitation of the divine mechanism of the human eye, he was led, in 1729, to the combination of media of different refractive powers; and, in 1733, he had actually completed several achromatic object glasses of flint and crown glass. No account of this invention was published; and there can be no doubt, that when John Dollond began his experiments, he was entirely ignorant of the previous labours of Mr. Hall. When he succeeded, therefore, in 1758, in the invention and construction of this noble instrument, he obtained, as he justly deserved, all the honours of a first inventor; and when he introduced these telescopes into actual use, and made them an object of English manufacture, in which no foreign nation could

compete with us, he conferred a service upon his country of no ordinary kind. That service, however, though it exalted the honour, and improved the revenue of the nation, stands unappreciated and unrequited in her annals; and, as if the great dispenser of justice had frowned upon the ungrateful deed, no improvement upon the achromatic telescope has been allowed to mark the future progress of English science;*—it has passed into foreign states as an article of trade, as well as an object of glory, and the sovereigns of other lands have fondly welcomed into their territories what we had dishonoured and rejected. Attempts, hitherto fruitless, have been made to perfect the invention of Dollond, and to extend its power. The Royal Society, too, has been roused from its long and deep slumbers; they have appointed a committee to make experiments on the manufacture of flint glass for achromatic telescopes;—they have erected an experimental glass house; and government were persuaded to extend to them the mighty privilege of melting a few pounds of glass without being visited and taxed by the excise officer. For half a century after the death of Dollond, no philosopher or artist in England was allowed to make experiments for the improvement of flint glass, without paying the tax to government, and without submitting to the harassing interruptions of the tax gatherer. Nay, by a singular refinement of extortion, a pound of glass re-melted *fifty* times, was liable to the duty upon fifty pounds!† Under these circumstances, we hailed the appointment of the glass committee, and the remission of the excise regulations, as an era in science; but ardent as we are in every measure that can endear the name of England, and advance its interests, we are compelled to state, that this committee never will, and never can accomplish the object for which they were associated. Their chemical and physical knowledge will doubtless avail them much in such an inquiry; or if preferred to an enterprising individual, whose fortune or renown depended on the issue, it might in all probability ensure him of success. But how is it possible to suppose, that Mr. Davies Gilbert, Sir H. Davy, Dr. Young, Mr. Herschel, and Mr. Babbage, can spend their hours and their days in the atmosphere of a furnace? Will they leave the pursuits which have already immortalized them, to labour in a cause in which success would neither inspire gratitude nor command requital? Will they, in fine, devote themselves to re-discover a discovery which has been already made by a Swiss peasant, in the gorges of the Jura,

* There are telescopes executed by John Dollond, which, we believe, have not been surpassed by any since made of English materials, and by English workmen. Many improvements have been proposed, but none of them have yet come into practical use, or have been substituted for the common achromatic telescope.

† The writer of this paper feels himself entitled to utter these complaints. He had laboured many years on the theoretical part of this subject, and when, in commencing to put his views in practice, he asked the assistance of a friend, he learned with grief and indignation, that he had subjected himself to the statutory penalties. Need we add, that his hopes and his crucible were together dashed upon the ground.

and which the British government could have purchased for a paltry equivalent.

The history of M. Guinand's labours possesses a peculiar interest. An English achromatic telescope found its way to the village of Brenetz, in the canton of Neuchatel. A defect of sight had compelled M. Guinand, a maker of watch cases, to construct his own spectacles. From this he was led to grind the lenses of small refracting telescopes, which he mounted in tubes of pasteboard. To such a mind, the sight of the achromatic telescope which belonged to his master, must have been an object of high interest. He was allowed to separate the lenses, and study its properties, and such was his zeal to imitate this optical wonder, that he commissioned some flint glass from England, and actually constructed with it several achromatic telescopes. The badness of the glass, however, and the impossibility of procuring it of the size he required, inspired him with the ambitious resolution of making good flint glass for himself! We are sure that no chemist in England or France would have ventured on such a task with any hopes of success; but ignorance was in this case power; and glass fortunately was not an exciseable commodity in the village of Brenetz. He studied the chemistry of fusion;—between 1784 and 1790, he made daily experiments in his blast furnace with meltings of three or four pounds each;—he noted down the circumstances and the results of each experiment. Partial success invigorated his ever failing efforts, and the news of learned academies having offered prizes for the object at which he strained, animated him with fresh and glowing excitements.

Having abandoned his profession for the more lucrative one of making bells for repeaters, his means became more ample, and his leisure hours more numerous. He purchased a piece of ground on the banks of the Doubre, where he constructed a furnace capable of fusing *two hundred weight* of glass. The failure of his crucibles, the bursting of his furnace, and a thousand untoward accidents, that would have disconcerted any other mind, served only to invigorate his. The disappointments of one day were the pedestal on which the resolutions of the succeeding one reached a higher level; and in the renewed energy of his spirit, and the increasing brightness of his hopes, the unlettered peasant seems to have felt that fate had destined him to triumph. The threads, and specks, and globules which destroyed the homogeneity of his glass, were the subjects of his constant study; and he at last succeeded in obtaining considerable pieces of uniform transparency and refractive power, amounting sometimes to twelve, and in one case to eighteen inches in diameter. He at last acquired the art of soldering together two or more pieces of good glass, and though the line of junction was often marked with globules of air, or particles of sand, yet by grinding out these imperfections by means of a wheel, and by replacing the mass in a furnace, so that the vitreous matter might expand, and fill up the hollows so made, he succeeded in effacing every trace of junction, and was consequently able to produce with certainty the finest disks of glass.

Rumours of Guinand's success had now begun to spread throughout Europe, and the first philosopher who availed himself of the intelligence was M. Fraunhofer, of Munich, who had the charge of the optical part of the establishment of Benedictbaiern. He was so pleased with the specimens which were sent to him, that he repaired, in 1804, to Brenetz, and persuaded M. Guinand to go on to Bavaria, where he settled in 1805, and continued for nine years engaged in the manufacture of flint glass.

In 1820, long after his return to Switzerland, the celebrated French artist, M. Lerebours, visited him, and not only obtained all the glass which M. Guinand then had, but commissioned a fresh supply. M. Cauchoix, another excellent Parisian artist, procured other pieces, and splendid achromatic telescopes have thus been manufactured in the French capital. Though possessing the deepest interest, England seemed the least alive to these great discoveries. She sent no delegate to Brenetz—she made no offer for the secret; but, in 1822, a piece of Guinand's glass was obtained by the Astronomical Society of London, and formed into a telescope by our excellent artist, Mr. Tulley. Its homogeneity and purity, nay, its absolute perfection, has established the value and the efficacy of Guinand's process.

The visit of Guinand to Munich, in 1805, led to a new era in the history of the achromatic telescope. Commencing with all the knowledge of the Swiss artist, Fraunhofer devoted his mind to the perfection and simplification of his methods. Striæ, and imperfections of a minute kind, which the practised eye of an optician could alone detect, still required to be eradicated; and even the crown glass, which had hitherto been supposed an object of easy attainment, required the labour of a whole year to bring it to perfection. In order to gain these ends, Fraunhofer re-constructed the furnaces at Benedictbaiern, procured all the instruments which were necessary for his purpose, and took upon himself the charge of all the meltings. Four quintals of glass was the average quantity with which he wrought, and he at last succeeded in determining the causes of his failure, and in obtaining distinct processes, by which he could manufacture disks of flint glass, eighteen inches in diameter. In these laborious and perplexing experiments, Fraunhofer injured his health, and quickened the progress of that insidious disease which carried him off so prematurely from the sciences.

But while Fraunhofer had thus supplied himself with the finest materials for his art, he had prepared his mind, by the study of optics, both in its mathematical and practical branches, for carrying into effect his great views for the improvement of the telescope. His discovery of fixed lines in the spectrum enabled him to determine, with minute accuracy, the absolute, as well as the relative, refractive and dispersive powers of his glass; and his skill in practical mechanics conducted him to the construction of a machine for giving the last polish to his lenses, an operation in which the errors of the previous process of grinding were corrected, in place of being

exaggerated, and in which the result was made perfectly independent of the skill of the workman.

With such means and accomplishments, Fraunhofer began the most difficult task to which human genius was ever applied. The resources of his powerful mind never, for a moment, failed him; and though the malady which beset his delicate frame often broke the continuity of his labours, and though disappointment often threw its shadows across his path, yet, sustained by the ardour of his genius, and by the liberal patronage of his sovereign,* he triumphed over every obstacle. The great achromatic telescope of Dorpat, with which professor Struve has made such important observations, will remain an imperishable monument of his genius, even if it has not been exceeded by his later, and, we believe, larger instrument. Had he been spared a few years, he would have astonished Europe with an achromatic object glass *eighteen inches* in diameter; but the honour of executing such a work has been left for another age, and probably for another country than Bavaria. We have not been able to learn to what extent his partner, and his workmen, possess the methods and processes of Fraunhofer: but, even if he has not left his mantle behind him, the force of his example remains, and we gladly indulge the hope, that the spirit of science and commercial enterprise will be again combined in the continuation of his labours.

The eighteenth century is an age that will ever be noted in the annals of the world, as one in which science of all descriptions made a progress unexampled in the whole previous annals of the world. It is also in the branch of science we have been considering that this progress has been the most marked. The theory of gravitation, proposed by Newton at its opening, has been pursued, and applied, during its lapse, to all the known existing combinations of bodies and motions; and was, at its close, completed by Laplace. Proofs irrefragable and incontrovertible have been obtained of the motion of the earth, both diurnal and annual.† The dimensions of the solar system have been ascertained, and the sun and planets weighed as in a balance; while the discovery of a new and distant planet, at the close of this age, has doubled the bounds of the kingdom of the sun.

Instruments, and methods of observation, have been so far improved, from a comparatively imperfect state, as to leave little to desire or look for hereafter.

The astronomers of the early part of the present century have made some few, but important discoveries, that probably complete our knowledge of the district of creation in which our earth is situated; and those of the present day, like Alexander, seek for other worlds to conquer. Unlike him, however, they have no cause to weep, for in the regions of immeasurable space there exist, within our ken, bodies, and systems, and motions, that may, for ages to come, task their utmost exertions.

[*Extractor.*

* Maximilian Joseph, king of Bavaria--*clarum et venerabile nomen!*

Some account of the Structure and Operation of GURNEY'S Steam Coach. By C. H. WILKINSON.

SIR,—I presume, from the great public attention excited by Mr. Gurney's steam carriage, that a short account of the means by which the whole is propelled, may prove interesting to your readers. I confess that, previous to the opportunity afforded me by the liberality of the patentees at their late visit to Bath, that I contemplated all attempts to substitute mechanical powers for living action as impracticable, unless the resisting medium is in a uniform measured degree, as in rail-roads, &c. It appeared to me, that the constant changes arising from the inequalities of roads, and those ascents and descents which are in the line of communication between Bath and London, could never be counteracted by that perpetual alteration in the force of steam, as such conditions would require. The horse in an instant accommodates his force to the degree of resistance to which he is exposed; the construction of an inanimate machine, competent to produce corresponding effects, appeared to me to be attended with insuperable difficulties. Mr. Gurney's journey to Bath, and his return to London, have induced me to believe that the principal point is attained; and I think the patentees have judiciously concluded to confine its operation to short stages from London, which will afford them opportunities of rendering it more perfect before any extensive line of road is proceeded on. The merit of every machine principally depends on its simplicity. In this respect Mr. Gurney's plan is entitled to every admiration. The power he generates is very little reduced by friction, and nearly its whole force is employed, as the propelling agent. The boiler, or generator, as it is termed, consists of about twenty gun barrels, three feet in length, communicating at each end with an iron tube, by which arrangement a general communication is effected with every tube, and the barrels are about one inch from each other, and serve as a grating for the fire above, which is fed with coke from the inside of the carriage; a second fire is placed under the barrels, and supplied from the outside; so that this chain of tubes is placed between two fires; these tubes are completely filled with water, so that whatever degree of heat is employed, the water retains its fluid form, and does not assume a vaporific character before its liberation from the heated barrels; if any additional portion of water be determined into these barrels with a force capable of overcoming the resistance of the valve; then a corresponding portion of water passes into an iron cylinder, about seven or eight inches wide, and two feet long, and immediately flashes into steam; this part of the machine is called the separatory, and answers an important purpose in regulating the force of steam; suppose ten drops of water be converted into steam, at a temperature of 212 degrees, that steam, subsequently exposed to any higher degree of temperature, will not have its powers of pressure increased without an additional dose of water—the separatory supplies the deficiency; so; on the contrary, if the fire be not sufficiently active, the steam contains a surplus of water, and which excess is

deposited in the separatory, and prevents the working cylinders from being overcharged with that fluid; from the separatory the steam is alternately determined into two cylinders, which are six inches in diameter, with a stroke of 20 inches; the rods of the pistons are attached to cranks on the axle of the hind wheels, these cranks are reverse to each other, and hence by the reciprocating action of the pistons, a complete revolution of the axis takes place; at each end of the axis is a bar of iron the width of the wheel, and secured at each end by bolts to the circumference; by this adjustment the powers of the pistons are advantageously applied to the circumference of the wheel, and the strain prevented which would be the result, if nearer the nave. As the pistons are elevated by the steam, two pumps are worked by rods going through stuffing boxes, and are attached to the piston at the other end; these pumps communicate with the cistern of water, a small portion of which is determined into the generator, to produce the effect already noticed; the stream is afterwards directed into a cooling cylinder, through a worm, part of which is condensed, and returned to the cistern, and the other portion passes immediately through the chimney into the atmosphere.

The average pressure is about eighty pounds to the square inch of the surface of the piston: it is ascertained that double the pressure does not require the same proportionate increase of fuel; and as economy in this respect is of great importance, the steam in the first instance possesses a power equal to one hundred and sixty pounds, and the communication with the separatory is cut off when the piston has moved through half its range, the expansion of the steam is competent to effect the passage of the pistons through the remaining part of the barrel.

Close by the engineer is a governor, by which he is enabled to regulate the steam, either by increasing its force or diminishing its quantity; and this important part of the operation is managed with great facility.

From coke being employed, and the steam considerably cooled, there is no perceptible smoke, nor clouds of vapour, and the cylinders working about thirty times a minute, the same number of revolutions of the hind wheels take place, supposing the circumference to be fifteen feet, the velocity would be nearly six miles per hour; on level ground, it will move through three times this space, so that there would be ninety strokes per minute; under such circumstances, the steam has a less pressing power, from the water not remaining so long in the generator. The metal which is employed is forged iron; if from any circumstance the pressure of the steam should overcome the resistance of the metal, no explosive effects would be the result, and no dangerous consequences would follow; the iron would rend, and the steam would escape through this small separation, and the action of the machine is necessarily stopped, and it is only by such a cessation that a solution of the continuity in any part of the apparatus is suspended.

One bushel of coke will suffice for two miles, and one gallon of water is consumed each minute: hence every eight or ten miles a

fresh supply of water is required, and every twenty or thirty miles, coke.

From a comparative statement of the relative expenses, if we estimate the apparatus and wear equal to four horses, the engineer and stoker as corresponding to the coachman and guard, then the expenses will be reduced to the small compass of travelling. I understand that four horses are estimated at 2s. per mile; while the coke required would not exceed 3d. so that the difference of expenses would be as 3d. to 2s.

Probably a more important result would arise whenever the time shall arrive for the general employment of this mode of travelling: upon a moderate computation, in the British dominions, a million of horses are appropriated to this purpose, as each horse consumes that produce from land equal to the support of seven men, a change of agriculture would be the result, and food for seven millions of inhabitants thus created. From such a reflection, I am induced to conclude with the noble duke at the head of our government, that the advantages are probably incalculable. [*Register of Arts.*]

Notice of Chrome Orange.

IN Brande's Quarterly Journal, from October to December, 1829, Mr. Graham remarks, "It is singular, that, although no other colour has been so much run upon for a couple of years in cotton yarn, no account of the mode of raising this beautiful tint, so far as I can learn, has hitherto been published; yet this process is universally known, and followed by dyers. The first object is, to procure upon the yarns a good body of chrome yellow, of the ordinary and familiar tint of chromate of lead. For this purpose, the goods are well charged with protoxide of lead, which is done by dipping them in a solution of acetate of lead, and then decomposing the salt by lime water, of which the lime takes the atetic acid, and leaves the oxide of lead in the cloth. Every trace of lime must then be got rid of by washing.

It is necessary to have nothing but oxide of lead on the cloth; for, with acetate or nitrate of lead, as the mordant, the colour will be uneven. The goods are then passed through a bath of bi-chromate of potassa, which instantly strikes the chrome yellow with the oxide of lead.

The orange is raised by throwing the goods so prepared into lime water at, or near, a boiling heat. Lime, at that temperature, appears to be capable of partially decomposing the chromate of lead, taking half the chromic acid from a greater or less portion of that salt, and reducing it to the state of di-chromate of lead. The di-chromate of lead is itself of a full red colour."

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OF THE
State of Pennsylvania;

DEVOTED TO THE
MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,
AND THE RECORDING OF
AMERICAN AND OTHER PATENTED INVENTIONS.

MAY, 1830.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN FEBRUARY, 1830.

With Remarks and Exemplifications, by the Editor.

1. For a *Mill for Preparing Bark* for tanning; Merrit Hurd, Augusta, Oneida county, New York, February 1.

A wooden cylinder turns upon gudgeons; this cylinder is furnished with rows of steel teeth set spirally round it. A bar of iron crosses the frame, and is placed so as just to clear the teeth of the cylinder. The bark is to be put into a hopper above the line of operation between the bar and cylinder. There is no claim whatever.

2. For an improvement in the *Application of the Lever*; Benjamin Morris, Birmingham, Broome county, New York, February 2.

This *improvement in the application of the lever* is merely a rack and pinion press, not differing in the slightest particular from the well known modes of applying this power. In the drawing there are two wheels and two pinions, and we are told that the wheel to which the power is applied may be turned by an endless screw; by a pinion and lever; or by a rope acting upon its periphery by means of a windlass and lever.

The puzzling task of finding any thing in this machine to which to lay claim has very wisely been avoided.

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3. For a machine for *Drilling Rocks for Blasting*; John W. Post, Washington City, and Calvin Post, Springport, Cayuga county, New York, February 2.

A frame is made, in the centre of which an iron shaft or rod is caused to rise and fall vertically between friction rollers so placed as to keep it in its position. In the lower end of this shaft a socket is formed to receive drills of different sizes. Provision is made for placing the machine vertically, by sliding pieces upon each of its four legs, which serve to lengthen them as may be necessary. The apparatus for working the shaft up and down is formed as follows: a circular plate of iron, about a foot in diameter, has a hole in its centre, provided with a socket adapted to the iron rod, or shaft, and capable of being secured at any part of it, so that the plate will stand horizontally. At a little distance from the periphery of this plate an iron spindle crosses the frame; upon this spindle are lifters, which, as it is turned by a crank, come in contact with the lower side of the plate, and raise the shaft; friction rollers are contained within the lifters, to cause them to slide easily upon the plate, and their action is so managed as to produce a small revolution of the plate, and consequently of the drill, at every lift.

The claim is to "the general principle contained in the foregoing description."

4. For an improvement in *Forming the Nap upon Woollen Cloths*; Zachariah Allen, Providence, Rhode Island, Feb. 2.
(See specification.)

5. For a *Machine for Washing Clothes*, called the VIBRATING WASHING MACHINE; Samuel Silliman, Saybrook, Middlesex county, Connecticut, February 3.

A vibrating frame is supported by two uprights above a trough, or box, which is to contain the clothes and suds, "at the bottom of the vibrating frame are five wooden rollers of an inch and half diameter, one-fourth of an inch distant from each other, with iron, or other metallic arbors, or centres, at their ends, fitted to, and running in, boxes of pewter, or composition, and attached to the bottom of the side pieces. The line of the rollers conform to the sweep of the vibrating frame." A false bottom, consisting of fluted boards, and perforated with holes, is retained by ledges in a situation suited to the action of the rollers. The gudgeons of the vibrating frame work in a slot, or mortise, to enable it to adapt itself to the inequality in the thickness of the clothes; the false bottom also gives way, as there are no ledges below it, but it is forced up against those above it, by the water in which it floats. The vibrating frame is worked by a handle, which is affixed to one of the cross pieces which unite its two sides, and this handle is further secured by a brace extending to another cross piece. We mention these minute points, because they

appear to the inventor of great importance, as is evinced by the attention paid to them in the claim, which is as follows:—

“The wash board detached from the tub, perforated and raised from the bottom; the rollers attached to the vibrating frame, with metallic arbors and boxes in the manner described, aforesaid, with the slide of the frame in the mortises of the shaft, together with the handle placed as aforesaid, are claimed as an entirely new application in the washing machine.” Unfortunately, nearly the whole of these entirely new applications, have been long known and used; the floating bottom may be new.

6. For an improvement in and on *Package Pumps for Raising and Conducting Water* to any place desired; John A. Smith, Windham, Windham county, Connecticut, February 3.

When we hear of an improvement in pumps, our anticipations resemble those which would be raised by the possession of a lottery ticket, a prize is possible, but a blank is almost certain. We apprehend that on the present occasion, the patentee will find that his prize is like that of “2538” in the play.

What is meant by a *package pump*, we do not know, but let this pass, as our ignorance abstracts nothing from the value of an invention, we will therefore tell, as well as we can, how this pump is constructed, and enable our readers to form a judgment for themselves.

There are two barrels, the pistons of which are worked by racks and a pinion, in the manner of the double barrelled air pump; we are not so told, but it follows from their operation that they are to be lifting and forcing pumps, with their piston rods working through stuffing boxes. The first thing claimed as a new invention is the fixing the barrels over a box, or receiver, capable of containing a considerable portion of water. “The advantage of this receiver is to prevent the motion of the pistons pulling the stream in two, or causing friction, and affording a constant supply of water, so that when the valves lift, there will be no danger of forming a partial vacuum.” This is all very good, though not very new, but, if the drawing furnished is to be our guide as regards the structure of this pump, we shall find the proposed good completely counteracted by the size of the shaft which is to descend into the well or fountain; and which is represented as a tube the section of which would be about equal to *one-twentieth* of one of the pump barrels.

The water is to be forced up a tube, extending to any height required, and to prevent the water from freezing in this tube, the patentee claims “to have invented the application of a *thief*, or a small outlet, taking the water out of the main pipe,” and conducting it into a reservoir, or tub, from whence it may be conducted to a barn, shed, or other place where it may be wanted. Wherever water works have been established, we apprehend that *thieves* of this kind have been known and used; it is a common practice in Philadelphia

and elsewhere, to have such waste water tubes, to prevent the bursting of the pipes by frost.

7. For an *Improvement in Steam Navigation generally*; John M. Patton, Milton, Northumberland county, Pennsylvania, February 4.

(See specification.)

8. For an improved *Machine for Grinding Flax-seed, and other kinds of Grain*, paints, medicines, and other substances; Asahel Cross and Ezra Brown, Cazenovia, Madison county, New York, February 4.

(See specification.)

9. For a *Double Revolving Churn*; Luther Barney and Abel A. Beach, Groton, Tompkins county, New York, February 5.

We believe that there is something new, at least, in this churn. It consists, in part, of a vertical tub, much in the form of the ordinary churn; this tub is fixed in a frame, and is supported upon pivots above and below its centre or axis, to allow it to revolve; a shaft passes through its top, and is surrounded by dashers, which consist of strips of wood set obliquely, and spirally, in the manner which has been frequently practised. A vertical cog wheel, turned by a crank, meshes at its upper side into a wheel upon the dasher, and at its lower into a wheel upon the top of the churn, causing both the shaft with the dashers, and the churn itself to revolve, but in opposite directions. There is no claim.

10. For a machine for *Washing Clothes*, called the REVOLVING STEAM WASHER; Luther Barney and Abel A. Beach, Groton, Tompkins county, New York, February 5.

For what reason this is called a steam washer, does not appear. The machine consists of an oblong box hung by gudgeons on the middle of its sides, and turning upon them, by means of a crank, with the aid of a wheel and pinion. The gudgeons rest upon the edges of a second box, or trough, made large enough for the former to revolve in. To the first, or tight box, there is a cover which must be removed for admitting the clothes and suds; this, when replaced, must fit perfectly tight. Within the tight box are placed pins, near each end, upon which the clothes are to fall as the box revolves, and to sustain them whilst the suds presses upon, and passes through them. A cock is inserted in this box, which the patentee tells us may be opened to admit air from the mouth *to increase the pressure*. How it will effect this, it is beyond our philosophy to tell, as we should apprehend that the condensed air would still press equally on each side of the clothes, and therefore lend no aid in forcing the suds through them. There is no claim.

11. For an improvement in the *Steam Engine*, called THE LUBRICATOR, for applying lubricating substances to the inner surface of the cylinder; Benjamin Reeves, Philadelphia, Pennsylvania, February 6.

The claim of the patentee exhibits pretty fully the general object of the patent; it is in the following words. "What I claim as new, and as my own invention, is a mode, or modes, by which lubricating substances may be applied to the interior surface of cylinders or other vessels in which moving pistons operate, in steam, hydraulic, or other engines, in such manner as to prevent their escape to the cavity of the cylinder, or other vessel, other than by contact with their surfaces."

Several modes, it is said, may be adopted for the purpose indicated, one of which is described in the specification; it consists in leaving a cavity around the piston, in the centre of the packing, which cavity is to receive the lubricating substance. A ring of iron, or other metal, is made of the size of the interior of the cylinder, a groove is formed on the outer edge of this ring, and when the piston is packed the ring is to be inserted in the middle of it. A tube, with a funnel and cock attached to it, passes through the side of the cylinder, and whenever the piston is brought to rest with the cavity opposite to the tube, the lubricating matter may be admitted. There is a second tube and cock on the opposite side of the cylinder to allow of the escape of air, or vapour, which might obstruct the influx of the lubricating fluid. "The lubricator may be supplied when the engine is in operation, by means of cams, or other contrivance."

12. For an improvement in the *Cutter Plough*, called the "Shovel Cutter;" Samuel Wilson, Darlington Court House, South Carolina, February 6.

The variations in the plough, and in some other machines for which numerous patents are obtained, are frequently so small, as not to appear very distinctly to ourselves, from which cause we are not prepared to exhibit them clearly to others; such is the case in the present instance; the claim is to "the construction of a cutter plough to run on [a] Bull-tongue, or shovel stock, thereby saving two-thirds of the expense of stocking a common cutter plough; and that on the same stock may be run the common Bull-tongue and the Eagle, all of which are much used on our farms." The following is a part of the description. "This plough is made entirely of wrought iron, with wing, bar, and helve, the wing may be any length, width, or thickness. The wing is welded to the Bull-tongue, or helve, and the bar extending to the bottom of both," &c. &c. There is a drawing, but it is *without* "written references," which the law demands.

13. For an improvement in the *Casting and Setting of Types for Printing*; William R. Collier, Boston, Massachusetts, February 9.

The object proposed is to lessen the labour of setting and distributing type, by casting certain particular combinations of letters in one moveable block, instead of in two or three. "The instances of two or more letters connected, or united, and cast into one moveable block, or type, for which I claim a patent, are the following."

"at, and, as, al, au, ad, ar, ac, am, be, ch, co, ce, do, de, di, es, er, em, en, ed, he, is, il, it, ly, le, li, lo, me, ma, mi, mo, ne, no, ug, ud, ou, or, pe, po, pa, ra, ri, ro, st, sh, so, si, the, ur, ut, us, ul, ve, we, wo."

The patentee states the manner in which he proceeded in making the foregoing selection, as embracing those most frequently required: he also adds a sketch of the arrangement of a case, where these additions to the fount are used; he does not, however, claim this arrangement as included in his patent. He afterwards observes that "the following combinations of letters have been devised by me in addition to those for which I claim a patent in the preceding pages of this document; they are as follows:"

"ab, ap, ag, by, bl, ba, bi, be, ct, ci, ca, cu, da, du, ea, ev, ei, ec, et, el, eb, en, ef, ec, ha, had, hi, ho, fo, fe, fa, fu, ga, gi, ge, go, gh, gy, im, if, iv, ke, la, lu, my, nt, ne, na, ni, ny, us, ob, oc, ol, oy, om, os, ot, od, op, oro, pr, pu, pi, ry, rd, ro, ru, su, sa, sl, tr, to, ty, ta, ti, tu, um, ud, va, vi, vo, wa, wi, yo, bo."

"The above combinations are of the same nature, and were invented in the same manner and at the same time with those for which I claim a patent, but as they are not so useful, I do not *at present* intend to ask a patent for them. They are inserted, however, as a proof of the priority of my invention."

If the patentee intends at some future day to ask a patent for the foregoing combinations, we apprehend that his insertion of them in a public document will not operate as a caveat, and protect his right for a given time. Patents can be sustained only for what is new, a quality not communicated or increased by time. When our discoveries have been ushered into the world, they, like ourselves, are daily waxing old.

14. For *Carding and Dressing Cloth* by machinery, called the "Fuller's Nap and Card Machine;" Joseph Groff, Rappo Township, Lancaster county, Pennsylvania, February 10.

The cloth is made to pass successively over a press roller, a card roller, and a dress card, on a flat board. The arrangement made, the patentee says, "has been found to answer the purpose intended of giving cloth a more regular and better dress than by hand." It would appear from the foregoing, that he entertains the opinion that cloth has never before been dressed by machinery. There is no claim made, either to the general arrangement, or to any particular part.

15. For an improvement in Edmund Warren's *Thrashing*

Machine; Daniel Mayer, Kingstown, Berks county, Pennsylvania, February 10.

We shall not refer to Edmund Warren's machine, as the one at present under consideration differs so little from many others, that we do not think much information would be obtained by the reference.

A cylinder with beaters, and the usual appendages, form this machine. The hollow segment in which the cylinder, with beaters, runs, is formed, like many others, of fluted rollers; a part of these are to be borne up by weighted levers. The grain after passing with the feeding cloth, is received between two feeding rollers which conduct it to the segment. These appear to be the *novelties*, as they are the points claimed. "What I claim as my invention is the construction of the above described machine, with the levers placed under the curved bed, with the weights attached to the ends of the same, formed of wrought or cast iron, and the stationary metallic grooves for the gudgeons of the rollers to work in, and the double rollers above mentioned."

16. For a machine for *Dressing Hemp and Flax after it is Broken*; William K. Scott, Sandy Hill, Washington county, New York, February 11.

We cannot, within the space to which we must confine ourselves in our monthly list and analysis of patents, give a clear idea of the above machine, which, both from the description and from credible information, we believe to be one of great value, as it certainly is one of much ingenuity.

It is probable that we may hereafter publish the description, with a plate; at all events, we will again take it up, and endeavour to give a clear abstract of the specification, which is of considerable length.

17. For an improvement in the *Power Loom*, called "The Improved Vibrating Cam Loom;" William K. Howard, Worcester, Worcester county, Massachusetts, February 12.

The patentee first describes the general construction of the power looms now in use, in order the more fully to illustrate his improvements. In doing this he refers to the drawings, without which it would be in vain to attempt a description. A vague idea of the nature of his improvements may, perhaps, be afforded by what he claims; he says, "I claim the particular method of applying the vibrating cams more directly, simply, and effectually, than ever before done; and also that of the cross girth. In pointing out my improvements, reference is to be had to the drawings deposited in the patent office."

"My improvement consists, 1st, in making the circular mortises (called 'vibrating cams,' as above) in the lathe standards, instead of having a separate piece for that purpose alone."

"2nd. That of applying the cross girth so as to admit of the cams

straddling said cross girth; and that part called the sway staff being hung on a pivot on the cross girth."

18. For a mode of *Unfurling the Condensed Woollen Roping in the Process of Spinning on the Common Jenny*; Cyrus Greenwood, Winchester, Cheshire county, New Hampshire, February 13.

To afford any adequate idea of the operation of this machine would require a drawing. There is a particular combination of wheels, a rack, and their appendages, for the purpose of communicating the propelling power to the drum shaft, by which the roping is unfurled; which combination constitutes the subject of the patent.

19. For an improvement in the *Percussion Lock for Fire Arms*; Samuel Forker, Meadville, Crawford county, Pennsylvania, February 13.

(See specification.)

20. For a machine called the "*Animal Rapid Rail-road Carriage*;" James Stimpson, Baltimore, Maryland, Feb. 16.

We know not the number of true and original inventors or discoverers of that kind of rail-way carriage in which the horse is to ride, walking upon a moveable endless floor running upon rollers, which are so geared to the wheels as to cause the carriage to travel at a rate many times exceeding that of the motion of the horse upon the floor. We have before alluded to it, as it has been previously patented, and has also been displayed in various newspapers, by means of a large wood cut. In all its essential features the carriage now patented resembles those to which we allude. It is proposed to make a very liberal use of friction wheels to support the gudgeons of all the revolving parts; there are also some other minor arrangements made which may be new, but it is not for these merely that the patent is taken, as will be seen by the claim.

"What I claim in the before mentioned carriage as my invention or improvement, is its application to horse or other animal power, whereby he or they can travel in and upon said carriage either upon roads or rail-ways, and by so doing impart a power to move said carriage with accelerated or diminished speed, compared with that of the actual travel of said animals."

"I also claim the application of the invention of friction wheels to sustain the weight of said animals, and the weight of the pulleys under the flexible floor; and the double rows of pulleys, or drums, under each band."

"Also the application of friction wheels to support the weight of the frame, animals, apparatus, and load, connected with and about said frame; said carriage itself being a new and useful improvement as a locomotive carriage, before unknown or used."

"I also claim the application of the gear principle, whereby a va-

riation of the speed of the carriage, more or less, is effected without varying that of the animals as hereinbefore described."

The gear principle alluded to in the last claim, is the placing upon the carriage wheel to which the driving power is applied a number of toothed wheels, concentric with the axis, so that by shifting the driving wheel from one to the other the alteration required will be effected.

21. For a composition called *Leather Paper*; Ephraim F. and Thomas Blank, New York, February 16.
(See specification.)

22. For a machine for *Cutting Plasterer's Laths* for the ceiling of houses, &c.; John N. Lynch, Dillsburg, York county, Pennsylvania, February 16.

This machine consists of a long plank, which operates as a plane stock; this plank is made to slide upon its edge, between upright standards upon a firm platform; a wide iron, like a plane iron, is fixed so as to cut on one face of this plank, much in the manner of the cutters of some shingle machines; the throat of the plane, if we may so call it, has other cutters standing at right angles with the first cutter, and at such distances apart as to reduce the laths to a proper width. The cutter plank is made to traverse by means of a pitman at one end, operated upon by any suitable power.

"What I claim as new, and of my original invention, is the entire machine as applied to the operation of cutting or dividing plasterer's laths, for ceiling houses, &c., and more particularly the dividing knives situated between the bearers for cutting laths to the proper breadth after they have been cut from the bolt by the main cutter."

The bearers above spoken of, are plates of iron which form a part of the face and throat, to prevent the wood from wearing.

23. For an improved *Truss for Ruptures*, called the "Spiral Spring Truss;" John J. Heintzelman, Philadelphia, Pennsylvania, February 16.

The specification sets forth that the trusses heretofore made have been very carelessly finished, so as to be but little calculated to answer the intended purpose. The improvements proposed are intended to obviate the defects arising from this cause, and to furnish an instrument more perfect in its operation. The circular spring, which is enclosed within the leather covering, is to be of well tempered steel, instead of hammered iron. The pad is to have two plates, forced apart by spiral steel springs. The circular spring is to be attached to the back plate of the pad by means of screws working in a slot, so that it may be lengthened or shortened as may be found necessary. There is a buckle to the strap in lieu of the ordinary holes and buttons. The claims are as follow.

"I claim every mode of junction of the truss formed on any union of the spiral, or other spring possessing elasticity, or rotary motion; with a slide in the circular spring, for lengthening or shortening the same; together with a buckle and strap for fastening the same around the body, which I find to answer perfectly well."

We believe that the lengthening and shortening of the truss by the slot, and tightening screws, is new; but the claim to "the spiral, or other spring, touches ground which has been pre-occupied, and that by more than one incumbent; the securing by a buckle, has been used; the studs and holes were adopted, probably, for the sake of economy, but the buckle has been frequently resorted to since, and certainly has been found "to answer perfectly well."

A good drawing accompanies the specification, but it is *without* written references, and therefore does not fulfil the demands of the law.

24. For an improvement in the *Machine for Stuffing Sausage Meat*; Samuel Fahrney, Washington county, Maryland, February 16.

Mr. Fahrney obtained patents for two machines, one for cutting, and another for stuffing sausage meat, dated December 9th, 1828.

The present stuffing machine differs considerably in its construction from the former; it is more simple, and, we doubt not, is a better instrument. A cylinder, with four wings, or leaves, is made to turn in a trough; these wings slide through the body of the cylinder, in the manner of the valves of Bramah's, Cooper's, and some other rotary pumps; a circular excavation in the trough, eccentric with the cylinder, serves to guide them in and out. A hopper is placed above the trough and cylinder, into which the cut sausage meat is to be put, which, on turning the cylinder, is carried down into the trough, by the extended wings or leaves, and round to the opposite side where there is an opening through which it is to be forced, the form of the excavation in the trough causing the valves to recede, and preventing the carrying of the meat out again. To the opening a tin tube is attached, which extends several inches in length out of the trough, and upon this the gut to receive the meat is to be drawn. When the crank is turned the meat is forced out in a continued column. The claim is to the general construction of the machine.

25. For a diving apparatus called the "*Submarine Explorer*;" Sewall Short and Noah Bradford, Barnstable, Barnstable county, Massachusetts, February 18.

This diving apparatus consists of a hollow buoy which floats in the water, and is in form like an inverted bell. Both ends of this buoy, or bell, are open. It must be made of light materials, and covered with leather, or other substance, so as to render it impervious to water. There is a platform, or seat, around it on the inside, to accommodate the assistants. To the lower end of the buoy is attached

a flexible water tight tube, which may be two feet in diameter, and must extend down nearly to the bottom of the water. The tube is distended by strong iron rings, and sunk by means of weights; its lower part terminates in a water tight dress, fitting the legs and arms, and kept distended, like the main tube, by suitable rings; light is admitted through openings occupied by strong panes of glass. The whole apparatus thus forms a bag open at top, but closed below. It is to be moored in a secure way, and to be of sufficient length to allow it to rise and fall with the motion of the water, without disturbing the operator.

A windlass is provided, which crosses the floating buoy, and is intended to draw the diver up when necessary, an air tube to force air down, and an hydraulic tube to pump any water up which may accidentally enter, are also appended.

The claim is to the general arrangement and construction of the apparatus as above described.

We have omitted the description of some of the auxiliary apparatus, as unnecessary to our purpose. An instrument of the kind described would probably answer well in places where the water was not very deep; at great depths, the operator would find it extremely difficult to move about, as the large leather tube, must, to a certain extent, move with him; the pressure of a current, running with moderate force only, would be immense upon a tube of the requisite diameter, when extended to a great length.

The dress intended to fit the arms, and the lower parts of the body, is very similar to what has been already introduced, and used with some success.

Any flexibility in the main tube, to allow it to rise and fall with the motion of the water, must exist at the upper part only, as the pressure at considerable depths would be such as to prevent any such motion; the tube must there be so kept out as to be incapable of being shortened by the folding in of the leather, or otherwise the buoy, or flat, would be drawn under water.

26. For the manufacture of *Paper from Straw, Hay, or other Vegetable Substance*; William Magaw, Meadville, Crawford county, Pennsylvania, February 19.

(See specification and remarks.)

27. For an improvement in the mode of *Cramping or Forming Boot Fronts*; Amasa Dunbar, Sharon, Norfolk county, Massachusetts, February 19.

A boot former of the ordinary shape is prepared, and is to be affixed by its back edge upon the lower side of a strong iron lever. Below the former a pair of cast iron jaws stand upon a firm bench: these jaws are so shaped as to receive the former when it is pressed down by the lever, and serve to press the leather so as to give it the intended set.

When the leather is placed upon the former, preparatory to its being forced between the jaws, it is clasped at its edges by pincers constructed for that purpose. These pincers are placed so as to straddle the upper edge of the lever, and are made to hold the leather on each side; the pincers are worked by a screw and crank, which draws the leather close to the former. The patentee considers the construction of these pincers "to be an entirely original invention, and a very important discovery in rendering the machine perfect in its application. It is designed to seize the leather as soon as it is presented on the form, and as the form is pressed into the jaws, the pincers, or elevator, being worked by the screw and crank, closes on the leather, and clasps and draws the corners into shape, which is the most essential part in forming the leather, and the most difficult to accomplish." There is no claim; the whole arrangement, of course, is considered by the patentee as new.

28. For an improvement in the *Drapery and Ornaments for Window and Bed Curtains*; William F. Phyfe, New York, February 19.

As the specification is a brief one, we give it entire.

"The improvement herein claimed consists of the mode of attaching the drapery. The drapery, which may consist of any suitable material, is first laid in pleats and sewed flat. At their heads the pleats are scoloped, forming points at each side, or double edge, to which the rings are secured. The rings pass through and turn in the bars, or other ornaments which are secured over the window in the ordinary manner. The subscriber claims the sole privilege of attaching his new style of drapery to the rings as above specified. He also claims the privilege of using drapery of any pattern as heretofore used."

"WILLIAM F. PHYFE."

Although patents of the foregoing class are of but little importance in a national point of view, and give nothing to the public in return for the exclusive right conferred, they are yet frequently valuable to the patentee. A contrivance, or device, which is the mere creation of fancy, and whose existence must be as ephemeral as that of fashion herself, must keep its reckoning by months, and not by years; still it is due to the individual who has made any device which will catch the public for a time, that those in the same business with him should not deprive him at once of all the benefit which he ought to derive from his ingenuity or taste. Were it possible to prevent the obtaining of patents for what is of no use to any one, much good would be thereby effected, but where an individual may be benefitted, and the public not injured, we would not proscribe them, although in a general point of view, they may be for objects which are absolutely trifling.

29. For an improvement in *Iron Dogs for Saw Mills*; Martin Rich, Candor, Tioga county, New York, February 19.

The dogs proposed to be used are similar in form to those generally employed, being that of a quadrant, or half bail, one on each side of the kerf in the head block; the following is the principal difference as stated by the patentee. "One of the half bails has three teeth, two of them on the upright part of the dog, one at the top and the other about the centre; these teeth must be of sufficient length and width for a screw to pass through each. Two screws are made of iron, about three-fourths of an inch in diameter, and about four inches long; these screws are for a set, or gauge, for the sawed side of the log to bear against. A nut about two inches square is put on the end of each screw, next to the log, also a nut on each screw on the other side of the tooth, for the purpose of binding the screw if it should ever wear loose." The teeth on the other dog are without screws, and are placed a little differently from the former.

"The advantage in the above described dogs over any other now in use, is, that the boards will all be of an equal thickness: that the saw will run entirely through the log; that it is more convenient to set in the night than any other."

"What I claim as my improvement, is the particular situation and construction of the teeth, and the screws to set the log."

30. For a mode of *Tightening Leaky Dams*, and so constructing new dams as to secure them from leaking; John M. Syme, Richmond, Virginia, February 22.
(See specification.)

31. For a *Pendulous Rail-road Car*; Samuel T. Jones, Philadelphia, February 22.
(See specification, page 149.)

32. For *Adapting Rail-way Carriages to run upon Ordinary Roads, &c.*; Samuel T. Jones, Philadelphia, February 22.
(See specification, page 151.)

33. For a method of *Raising Canal Boats, or Ships, Houses, &c.*; William W. Smith, Rochester, Monroe county, New York, February 23.

Nothing can well be more *simple* than the apparatus described in the specification, for raising boats, ships, &c. "Four or more levers acting on a fulcrum, one end of said levers pass under the bottom of the boat or object proposed to be raised; the other end of each lever is pierced by a screw of wood or iron, which enters the bed timber below, and passes into a wooden box sunk and secured under the surface of the earth."

"On the surface of each lever, and just below the head of the screw, is a platform of boards, or plank, which, of course, rise or fall with the end of the levers when the screws are put into opera-

tion, and are intended for the men to stand upon when turning the screws. The heads of the screws are pierced by hand levers, by which they are turned by the men standing upon the platform."

"In some circumstances, as in the raising of old boats, it may be necessary to have the two centre levers about five feet longer than the two outside ones; the usual length of the main levers is forty feet, and eighteen by twenty-four inches square in the centre, and the fulcrum is placed at, or near the centre. But I do not confine myself to these dimensions, as the length, size, and strength of the levers must be adapted to the nature and quantity of matter they may be required to raise."

"When a boat, or vessel, is raised sufficiently high from the water, a floating platform may be passed under the bottom for the workman to stand upon while repairing the boat."

We have thought it best to give the whole specification, that the merit of the invention might be completely before the reader. The whole is viewed by the patentee as new, as he has not claimed any particular part, and, as applied to the raising of *ships*, &c. out of the water, we apprehend that such a thing has never yet been attempted in this way.

A drawing accompanies the specification, in which a canal boat is represented as snugly stationed upon the ends of four levers, by which it has been raised to the horizontal position. The levers must have been at first very obliquely placed, when passed under the bottom of the boat, but it appears, notwithstanding, to have kept its place, without having been in the slightest degree abridged of its liberty by bolts, bars, ropes, or chains. A ship, probably, would have been much less tractable.

The modern contrivances for raising vessels from the water have become very numerous, but they are all unlike that of the present patentee, and we doubt very much whether the celebrated machines used by Archimedes, to the great annoyance of the Romans and their ships, bore any resemblance to it.

34. For an improved *Mill for Grinding Corn* and other substances; Increase Wilson, New London, Connecticut, Feb. 23.

"The improvement consists in the connecting two or more cast iron mills (or the grinding parts thereof) together, by means of several iron spur or bevil wheels, with iron shafts and coupling boxes, or clutches; so that by turning one shaft, one or more of said mills are put in operation."

"There is an advantage in having two or more small mills instead of one large mill to grind equally fast; *true*, small castings may be easily obtained, while those of a large size are apt to warp or spring in casting, and small castings are usually harder than large ones."

In the drawings, the mills represented are in the form of the ordinary patent cast iron coffee mill, with their hoppers. A second large hopper is to be made to surmount and to supply these with the grain to be ground.

35. For an improvement in the *Process of Finishing Woollen Cloths*; Zachariah Allen, Providence, Rhode Island, Feb. 23.
(See specification.)

36. For an improved mode of *Making or Manufacturing Spools or Bobbins* with collar barrels and boxed heads; William Clegg, Norwich, New London county, Connecticut, Feb. 24.

“The heads are made of two pieces of wood glued together with a round hole through them, and boxed partly through to receive the collar on the barrels; the barrels, and collars on their ends, are all of the same piece of wood, the collar entering the head, and the small part of the barrel passing through the head, and secured by glue, wood and iron, or either of them.”

It is said that the spools made in the manner adopted by the patentee, are not liable, like those formerly used, to have the heads separated from the barrels, broken, and otherwise deranged.

The description as given by the patentee, appears to us to be extremely obscure, and the drawing furnished is without written references; we collect, however, from the whole, that his spools, or bobbins, are turned with small heads, in one piece with the barrel, and that these small heads are let into others of the usual size, to which they are fastened by glue, or otherwise.

37. For a *Door Spring*; Isaiah Eaton, Boston, Massachusetts, February 24.

This appears to us to be a simple and neat application of a spring for closing doors. A barrel like that of a spring clock, encloses a spiral steel spring, which may be half an inch wide, and six or seven feet in length when unwound. One head of the barrel has a firm arbor, to which the inner end of the spring is fixed; this head is screwed on the under side of the upper part of the door frame. A cat gut, or other cord, winds around the periphery of the barrel, the other being fastened to a staple near the top of the door. The action will be at once perceived by every one acquainted with the operation of the main spring of a watch or clock. The barrel may be a neat brass box, and occupy but little room. When used for an outer door, the barrel must be fixed upon the door, and the staple on the door frame.

38. For an improvement in Hascalls's improved *Grist Mill*; William Coleman, Euclid, Cayahoga county, Ohio, February 25.

This is another addition to the list of portable grist mills, which have become so numerous as to leave but little chance of any essential variation in their construction, and, consequently, to render it difficult for the patentee to tell in what the novelty of his invention consists; all the account we shall pretend to give of the present invention, is contained in the claim set up.

“What I claim, is, the reducing the face of the running stone to

a plain surface; (whereas Hascall's is cone shaped,) and the making nearly a plain surface to the bed, or standing stone; (whereas Hascall's is deeply concave) and for resting the running stone upon the top of a convex spindle in a tapering mortise, by which the stone gains an undulatory motion, (whereas Hascall's is fixed firmly to the spindle, and has no other than a horizontal motion.) The stone may be hung upon a bail in the ordinary manner of hanging mill stones. I also claim the invention of a portable frame, by which the whole mill becomes portable, (whereas Hascall's is fixed to a certain spot.) And I also claim the right of applying 'Coleman's portable' mill to all the uses above mentioned."

Mr. Coleman seems to think that every variation from Hascall's mill must be a novelty, and will, therefore, entitle him to the claim of an invention. Mr. Hascall made one stone conical, and adapted the other to it. Mr. Coleman brings them both back again to the ordinary form of the face of mill stones, and makes a claim. Mr. Hascall fixes his mill to the floor, or to the building, and Mr. Coleman differs from him, as many others have done, by allowing the frame work to be moveable, and claims to be an inventor. We think that an examination of the patent office, and of other sources of information upon such subjects, would have eventuated in convincing the patentee that portable grist mills, flat stones, and runners with an undulatory motion, were every day contrivances.

39. For an improved *Press for Pressing Cheese*; Reynold Webb and Jonathan Coe, Madison, New Haven county, Connecticut, February 27.

The follower of this press is acted upon by eccentrics placed at each end of a shaft, or windlass; the cheeks of the press rise in the ordinary manner, with a bed piece upon which to place the cheese, or other article to be pressed; the follower is notched to fit, and slide within the cheeks, as usual. An iron, or other friction roller, is placed on the upper side of the follower at each end. Above these a shaft, or windlass, is fixed, the gudgeons of which turn in the cheeks. Cast iron eccentrics, or curved pieces, which operate as progressive levers, are fixed upon the windlass, and act upon the friction rollers on the follower, the windlass being turned by a lever. Such a curvature may be given to these pieces as may best suit the purpose for which the press is to be used.

The claim is to "the combination of the powers of the lever and wedge, or inclined plane, by means of the circular cross piece, [windlass] and the curved, spiral, or scroll pieces attached to the ends thereof, and operating on the small wheels, as described."

"The patentees state that "this process is simple in its construction, easily managed, and kept in order, portable, and possesses great power, which is easily brought into operation, and very little retarded or diminished by friction."

40. For a *Machine for Washing Clothes*; Charles L. Clowes, Union, Loudon county, Virginia, February 27.

On recurring to No. 10, p. 292, the description of a washing machine by Messrs. Barney and Beach will be found, and will answer perfectly well for the above; there, however, is an addition to the present machine, which consists of "a hollow cylinder, having pins, or projections, on every part for laying hold of the clothes within the revolving box." The revolving cylinder is placed loosely with the soap suds and clothes, within the revolving rectangular box. The claim is to "the *peculiar construction* of the above described machine, with the revolving rectangular box, and hollow cylinder within it."

41. For a *Machine for Cutting Sausage, or Minced Meat*; Jacob Robinson, Lancaster county, Pennsylvania, February 27.

A wooden cylinder is made to revolve within a box; this cylinder is surrounded by knives which pass between other knives fixed upon the sides of the box, the upper part of the box serves as a hopper, within which the meat to be cut is placed. The meat is to be repeatedly passed through these cutters, and thus reduced to a proper fineness.

There is no claim.

42. For an improvement in *Cradles or Cribs*; John M. Read, City of New York, February 27.

In this cradle the child is not to be rocked from side to side in the usual way, but is to receive a vibrating motion longitudinally. There is to be a frame made with four legs, in form something like a child's crib, within which the cradle is to be suspended; the suspension is effected by allowing four strips to hang from rails on each side of the frame, one near each corner; these strips work on pins passing through their upper ends, admitting them to have a pendulating motion; the lower ends of the strips are attached to the bottom of the cradle by pins, or joints, similar to those at top. To a lower rail of the frame a treadle is fixed, for the purpose of rocking the cradle with the foot; a string is also attached to the cradle by which it may be moved by a person in bed; or the string may be passed round a pulley, to enable the child to rock itself.

There is not any thing particularized as claimed, and we are, therefore, left to the conclusion that the whole is new; the kind of sifting motion given to the cradle we believe to be absolutely so; its utility we are unable to discover.

43. For an improvement in the mode of *Stamping Letters for Post Offices*, called the "Post Master's Stamp;" Asa White, Type Founder, Templeton, Worcester county, Massachusetts, February 27.

The improvement consists in making the types which express the name of the post office, wedge formed, so that they may be the better set in a circle like the stones of an arch. A metal block is pre-

pared, around which they are to be placed, and secured thereon by a brass ferule and a screw ring. The month and day are to be set in a mortise in the middle in the usual way. The block is to be attached to the end of a lever, having along side of it a stereotyped wheel, with the different rates of postage, and the words "free," and "paid," cut upon the face of it; this wheel can be turned round so that any rate of postage, or word upon its face, may be made to coincide with the face of the main stamp. A cup of printer's ink and a small inking ball, form a part of the apparatus; when the type is inked, the letter is placed upon a block, or cushion, and the stamp forced against it by the lever.

"What I claim as my own improvement, is, the stereotyped wheel; the manner of binding the types in the stamps; the shape of the body of the types, and the application of the lever, as described."

The post office stamps are now frequently made of cast steel, with the name of the office cut out of the solid, and a mortise formed for the date. Many have also been made of brass, but from the rough usage they often receive at the post offices, they are frequently defaced; steel, therefore, has been substituted. The objection to types is their brittleness, and the consequent facility with which they are destroyed by the careless hands in which they are placed; they certainly have the merit of superior neatness, but we think the durability of the steel stamps will secure to them a preference over all others, and that time will prove them to be the cheapest.

44. For making *Blind Fasteners*, called the "Gravitating Blind Fastener;" James A. Carver, Taunton, Bristol county, Massachusetts, February 27.

A few years ago blind and shutter fasteners were patented almost as frequently as churns, washing, and thrashing machines now are, but, for a while, they seemed to have run out. the varieties having apparently become exhausted. To us the present fastening bears the aspect of a resurrection more than that of a new creation; a bolt is to slide in a socket, so that it will fall down freely, like many other bolts, by its own gravity; this is to be fastened upon the lower rail of the blind; a catch in the form of those made for latches, is to be driven into the wall; to hold the blind back, and a similar catch driven into the window sill, to retain it when closed. The great difference between this and the kind now most commonly used, is that it is without a spring, falling into its place by the newly discovered principle, gravity. There is no claim whatever; a prudent precaution on the part of many patentees, and one, the frequency of which, in the present day, our readers must have noticed.

45. For an improved *Stove to be Heated by Stone Coal*; Philip Benedict, Lancaster, Lancaster county, Pennsylvania, February 27.

This stove is very much like the common ten plate stove, but, as

it is for coal, it is of course provided with a grate in the fire-place; "one other plate is set in the centre of the stove, crossways, the edge resting on the bottom plate, and fitting to the sides, and extending up within three inches of the bottom plate of the oven." This plate is the only point in which this stove appears to differ from the common stove; the use of it we are not told, but suppose it is intended to lessen the fire-place, and perhaps to force the heated air up against the lower plate of the oven; this manner of fixing the plate would leave a large hollow space behind the fire, respecting which we find no provision.

The claims are "the height from the bottom to the oven; the manner of dividing that part by a plate, the manner of placing the grate and lining, and the necessary doors, and applying it to the use of stone coal."

The particular dimensions of the different parts are mentioned, and of these "the height from the bottom to the oven" forms one of the claims. It is proposed to line the fire-place with plates of cast-iron, to keep the fire from acting directly upon the external plates; we are told, however, that instead of these plates, fire brick may be used; after this, the lining is claimed, then the necessary doors, and then the using the stove for stone coal, which completes the list of discoveries, or improvements.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in the Percussion Gun Lock, for Fire Arms. Granted to SAMUEL FORKER, Meadville, Crawford County, Pennsylvania, February 13th, 1830.

THIS improvement consists in the simplification of the percussion lock in the new formation and arrangement of the parts; dispensing with all superfluous fixtures, and reducing the number to six, viz.—the main spring, lever or cock, pivot, dog, tumbler pin, which also serves for trigger, and feather spring.

The main spring is affixed to the side of the barrel, and presses upwards against the lever (which is placed horizontally on the top of the barrel,) close behind the pivot. The lever is about two inches in length, with a concave hammer or a point, according as it is wanted for the percussion cap, or the grained percussion powder. It is let down into the pivot post, which stands perpendicularly on the side of the barrel, and is confined to its place, by a pin passing through it, about three fourths of an inch from the hammer. To the hinder extremity is fastened the tumbler pin, passing perpendicularly through the stock behind the breech, and which is provided with notches, which when the end of the lever is pressed down, take hold on a dog affixed to the end of the breech. When cocked, the lower end of the tumbler protrudes through the stock, and serves for a trigger. The feather spring is a thin piece of steel pinned to the back of the tumbler pin, or trigger; the upper end of which, pressing against the

hinder end of the lever, causes the notches of the tumbler to fall into a corresponding notch of the dog.

The inventor claims, as his exclusive improvement, the form and arrangement of the parts of the lock, so as to render it more simple, safe, certain and effective.

SAMUEL FORKER.

Specification of a patent for a machine for Grinding Flax Seed, and other kinds of grain, paints, medicines, and other substances.

Granted to ASAHEL CROSS, and EZRA BROWN, Cazenovia, Madison County, New York, February 4th, 1830.

On a horizontal shaft two feet six inches, or three feet in length and ten inches from one end of the same, is placed a cast iron wheel, eighteen inches in diameter, and one inch, or more, in thickness; the flat sides of which are turned straight and smooth. Two cast iron wheels, or cylinders, nine inches in diameter and four inches in thickness, the circular surfaces of which are turned straight and smooth, are placed on two shafts, two feet in length and near one end of the same. These shafts are placed in a horizontal position across, and at right angles with, the first mentioned shaft, and from three to four inches below the same (measuring from centre to centre) one on each side of the flat wheel, and in such a manner as to bring the smooth surfaces of the cylinders in contact with the smooth sides of the flat wheel; the outer ends of the cylinders extending as far as the outer extremity of the flat wheel at the point where they come in contact. The pivots on the ends of all the shafts run in boxes of metal, or other substance, attached to a frame prepared for the purpose.

The perpendicular flat wheel constitutes the principle of the improvement in the above machine, by operating between two cylinders, or rollers, similar to those heretofore in use.

Operation.

This machine is propelled by water, hand, or other power, by attaching a pulley and strap, or other gear, to each shaft. The seed &c. is fed from above into the machine, on each side of the flat wheel, between that and the cylinders. The flat wheel and cylinders are put in motion in a direction calculated to draw the feed between them; the flat wheel and cylinders making an equal number of revolutions in the same time. For some uses, this machine may be made much smaller than above described; but the flat wheel and cylinders should be nearly in the same proportion to each other.

The principle of this machine in its operation, in its improved form, is, it breaks the seed or substance, and at the same time, by the raking motion of the flat wheel against the cylinders, in consequence of their being placed below its centre, it effectually grinds or pulverizes it.

ASAHEL CROSS,
EZRA BROWN.

Specification of a patent for an improvement on Mordan's ever-pointed Pencil Case. Granted to JOSEPH SAXTON, Philadelphia, Pennsylvania, April 11th, 1829.

THE old construction of the ever pointed pencil case, on which said improvement is made, consists of a cylinder that slides inside of a case similar to those used for the ordinary cedar pencils, and may be slid in or out in the same way, being connected with the outer slide of the case by means of small pins or screws. Through the cylinder is cut a left handed female screw, in which acts a male screw, to which is joined the small wire that propels the lead. Part of this screw is filed away, so as to form two flat surfaces in order to slide in a slit cut in a second cylinder, fitted exactly into the first, and made to extend a short distance above it. To the upper end of this small cylinder is fastened a collet, which projects over the end of the larger one; and while it permits this larger cylinder to revolve freely on the smaller, prevents the latter from drawing out. The lower end of this smaller cylinder projects a sufficient distance below the other, to be held between the fore finger and thumb of the left hand, and inasmuch as the small screw passes through the slit in this cylinder, it cannot turn but as it acts in the thread of the outer cylinder which revolves by turning the case, this screw, to which the propeller is attached, must move either up or down, according to the way in which the case is turned.

The improvement on the above described pencil case for which alone a patent is claimed, consists, first in screwing the point through which the lead is propelled into the first described or outer cylinder within the case, to which the external slide is attached, instead of the inner or second above described cylinder, thereby making but one sliding joint between the point and outer tube or case. Secondly, in simplifying it by continuing the female screw in said cylinder its full length; so that the male screw of the propeller may act in the same thread into which the point screws. Thirdly, in causing the propeller to move by means of a piece of square wire attached to the upper part of the screw, whereby said screw is left whole, and the thread continued all round; whereas in the other more than one half of the screw is destroyed by flattening the sides, leaving but a small proportion of the thread to project out of the slit in the second described cylinder. By this new arrangement of the parts but one cylinder is required, which must be made of a size that will slide accurately in the outer tube or case. In this cylinder the propeller works by its screw made to fit in that of the cylinder. The upper or square end of this propeller must be rather more than double the length of the point through which the lead passes, so that it may always be within the square hole in the lower end of a tube above it, and within the outer tube or case. In the upper end of this tube is fitted a plug, having one end fastened to it, and after fitting a collet or band that shall revolve on this plug, the other end is to be fastened permanently to the first or upper section of the outer tube or case; and this

collet is then to be secured either by screw or otherwise to the inside of the upper end of the second section of the outer tube or case, which will prevent the inner tube or key that turns the propeller, from having any lateral motion; but will permit it to revolve with the upper part of the case to which it is connected; and by turning which (the lower section being held firm,) the propeller will move either up or down. It is for the above new arrangement and simplification of the parts, by which a cheaper, more convenient and durable instrument may be formed, that I claim a patent for a new and useful improvement on Mordan's patent ever pointed pencil case.

JOSEPH SAXTON.

Description of the Drawing.—Fig. 1. A longitudinal section of the case.

Fig. 2. The propeller, with its screw; the upper part of the propeller being formed of square wire.

A. Cap which screws on and closes the chamber for the spare pencils, and retains B in its place.

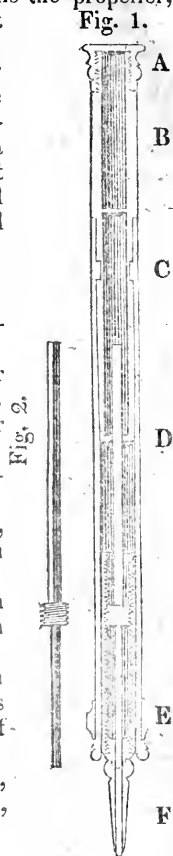
B. The part which is to be turned round to advance the pencil.

C. Collet which is soft soldered to the outer tube, but allows the inner tube or plug, to revolve when the part B is turned.

D. The lower end of the brass tube or plug, with a square hole in a piece which closes its end, through which the propeller slides.

E. The slide which retracts the point F, which point is screwed into the sliding tube; within this the female screw is shown, and the male screw of the propeller.

Mr. Philip Garret, watch maker of Market street, Philadelphia, is the proprietor of the above patent, and manufactures the cases.



Specification of a patent for an improvement in forming the Nap upon Woollen Cloths. Granted to ZACHARIAH ALLEN, Providence, Rhode Island, February 2nd, 1830.

THIS improvement consists in extending the cloth, upon which it may be required to raise a nap, very smoothly and firmly over a solid arbor, or edge, and in causing the wires, or cards, set in a cylinder, to act only upon that portion of the cloth which is passing in actual contact around, or over, the solid arbor or edge; thus bringing the wires to act by a gauge or screw with accuracy and certainty

upon all parts of the face of the cloth, and at the same time to penetrate no farther or deeper into the texture of the fabric, than may be found proper to raise a nap without injuring the texture of the cloth.

The improvement herein claimed consists in causing the wires to act upon a portion of the surface of the cloth extended smoothly over a solid body, so that every part of the cloth, thus extended on a hard surface or solid body, may be brought under the action of the wires without a possibility of retracting therefrom, or bagging in the looser parts, and without having some portions of it more intensely acted upon than others, whereby the nap is not only unequally raised, but the cloth itself is subject to be chafed through and damaged, as is the case when it is attempted to raise a nap otherwise than when extended upon a hard, smooth surface or cushion.

ZACHARIAH ALLEN.

Specification of a patent for Tightening Leaky Dams, and so constructing new dams as to secure them from leaking. Granted to JOHN M. SYME, Richmond, Henrico County, Virginia, February 22nd, 1830.

IN tightening a dam already built, an encasement, or work of plank and posts, is to be constructed the whole length thereof, reaching from the bottom of the stream to the top of the dam. The posts which secure this encasement are bolted to the works in the bottom of the stream, or otherwise effectually secured, and connected with the dam by strong ties. The space between the planking and the dam may be one foot, or more, according to circumstances, and is to be filled into the top with clay, or other proper materials, which must be well puddled and secured throughout; it is then to be closely sheeted over so that the puddling cannot be washed out or disturbed by the current passing over the dam.

In constructing a new dam, (in which case the expense will be considerably lessened,) the same plan is to be pursued. The puddling completely and effectually prevents the escape of water through the dam, and thus all the small particles which are usually carried through the interstices or crevices in the dam, with the small, but powerful currents of water passing through them, are lodged on its upper side, or face, and forced into these interstices by the great pressure of the water, and in a short time render the dam so compact, solid, and impermeable, as, after a time, perfectly to secure it, in all probability, from leakage, as long as the materials of the dam last, even if the encasement should be injured or destroyed. I claim as new and original the whole of the above described mode of tightening leaky dams, and so constructing new dams as to secure them from leaking.

JOHN M. SYME.

Remarks by the Editor.—Neither the principle or the practice pointed out in the foregoing description appears to us to possess any claim to novelty. The imperviousness of clay to water, has caused it to be frequently used in dams and embankments, to prevent leakage. Coffer dams are filled with it whenever it can be readily procured, and for the purposes of puddling it is frequently transported to great distances. We scarcely know of an idea more familiar to us than that of employing clay for the purpose, and in the manner above pointed out; we should have resorted to it in erecting a structure of the kind, without the most remote suspicion that we had been performing an operation possessing any of the attributes of a new invention or discovery, and had any one made the enquiry of us how a dam might be prevented from leaking, we believe that the first suggestion would have been the mode claimed in the foregoing patent.

Specification of a patent for certain improvements in the process of Finishing Woollen Cloths. Granted to ZACHARIAH ALLEN, Providence, Rhode Island, February 23d, 1850.

THIS improvement consists in laying the folds of woollen cloths smoothly between metallic plates, and in this state immersing the cloth in steam or heated water, and in subjecting the cloth, whilst thus immersed, in steam or hot water, to a heavy pressure, by means of a screw or otherwise. After remaining for a short time in this state, the cloth is allowed to become cold, or may be suddenly cooled by cold water, when it is to be withdrawn from the press. The cloth is then to be again folded in such a manner that those portions of the edges of the folds which were not subjected to pressure in the first instance, may be exposed to pressure in the second operation, which is to be completed in the same manner as the first. To prevent any marks, or impressions upon the cloth, from the edges of the plates, the cloth may be laid in folds of its full width, and made to extend together with the edges of the plates of metal by means of thin boards introduced between them, and of less superficial dimensions than the plates.

After undergoing the process, all sorts of woollen cloths are found to be rendered permanently more compact in texture, and consequently more serviceable in retaining warmth and excluding moisture, although comparatively more thin and light, whilst at the same time the cloth is rendered more smooth and glossy.

The improvement here claimed, and the advantages of this process over the usual mode of pressing woollen cloths, in a dry state, either cold, or with hot plates of metal, consist in the following circumstances, or parts—wool being a material very similar in its nature and properties to horn, (of which combs and other articles are formed,) if it be required to make any permanent alteration or impression on the texture of any fabric composed of it, the fibres of wool

must be rendered pliable by remaining immersed in hot water or steam. Whilst in this pliable and yielding state it may be easily compressed, or moulded to the desired form, and if allowed to become cold before this compression is removed, the form impressed will remain permanently. On the contrary, when pressed in a dry state the fibres of wool retain all their elasticity, and however intense the pressure may be upon them, they will soon recover their former position, and the effects will be transient.

ZACHARIAH ALLEN.

Specification of a patent for an improvement in Steam Navigation generally. Granted to JOHN M. PATTON, Milton, Northumberland County, Pennsylvania, February 4th, 1830.

To all to whom these presents shall come, be it known, that I, John M. Patton, in the county of Northumberland, and state of Pennsylvania, have invented a new and useful improvement in steam navigation generally, being applicable to steam ships, steam boats, &c. and particularly applicable to the navigation of canal boats by means of steam power.

This improvement consists in the use of a spiral or screw wheel, or wheels, to operate wholly under water—partly in the water and partly in the air—or wholly in the air, as resisting media, for the purpose of propelling or drawing the ships, boats, or craft of whatever description they may be, to which the said spiral or screw wheel or wheels may in any wise be attached for the purposes above specified; that is, to operate against air, or water, or both, and connected with steam power &c. for the purpose or purposes of propelling, or drawing ships, or boats, and craft of any description on any waters, or canals, within the United States. The spiral, or screw wheel is an *old invention*, and admits of a variety of construction, known to all practical and intelligent engineers, but as it is no particular construction, but the application of the spiral principle in all its various modifications to the purposes and in the manner above specified, that is claimed as a discovery, or new invention, hence I do not confine myself to any particular variety of the spiral, or screw wheel; to no particular dimensions, nor to the materials of which the same may be constructed; leaving myself full scope in the field of the mechanic arts to apply general and known materials and principles, in the construction of the spiral, as the nature of the case may require.

The preferable mode of applying the machine is believed to be at the stern of the vessel, or boat; the shaft of the spiral in the direction of the travel of the vessel, or boat; its size, the number of turns of the wing, or wings, of the spiral on the shaft, or whether the wing, or wings of the spiral be in a continued thread, or threads, or whether the same be formed in disjointed sections, embracing the spiral principle in any manner, is intended to be included in this specification,

and must be regulated to suit the power applied, and motion to be acquired.

JOHN M. PATTON.

Remarks by the Editor.—We have never been more completely posed than in endeavouring to find out what the patentee claims to have invented in this, confessedly, "*old invention.*" Nothing certainly can be more vague and general than his description; nor can we well conceive how any one could have more completely overlooked both the letter and spirit of the patent law, which declares that "every inventor before he can receive a patent, shall deliver a written description of his invention, and of the manner of using the same, in such clear and exact terms as to distinguish the same from all other things before known, and to enable any person skilled in the art or science of which it is a branch, to make the same." Act of 1793, Sec. 3. Instead of distinguishing his *invention* from all other things before known, he seems to have embraced all things past, present, and to come, appertaining to the subject. More than twenty-five years ago Gen. Stevens, of Hoboken, near New York, tried the spiral wheel "at the stern of the vessel, or boat; the shaft of the spiral in the direction of the travel of the vessel, or boat," and abandoned it as a very inefficient mode of propelling, although he made the essay with all that skill and perseverance which have distinguished him and his sons in their numerous and valuable experiments. We do not recollect when the first patent was obtained in the United States for a screw, or spiral propeller, but we remember that when Wm. J. Lewis, Esq., of Virginia, obtained his patent, on the 3d of February, 1819, it was not the first which had issued for the same thing, and we know that several have since been obtained for using the *spiral principle*, both in a *continued thread* and in *disjointed sections*.

We think it unnecessary to refer to the several instances in which we have had occasion to allude to this mode of propelling since commencing our monthly analysis of the patents. We have distinctly given our opinion that the mode itself is a bad one in all its forms; an opinion founded on some knowledge of the nature of the fluid medium on which the propeller is to act, and confirmed by the best test in all such cases, the test of experiment, perseveringly repeated, and ingeniously varied, but uniformly resulting in disappointment. Our present object has been to point out the entire want of conformity with the law when descriptions and claims are couched in terms like the foregoing, which, we are convinced would render any patent unavailable, however valuable the invention might be for which it was taken.

Specification of a patent for preparing Straw, Hay, or other Vegetable Substances, for the manufacture of Paper. Granted to WILLIAM MAGAW, Meadville, Crawford county, Pennsylvania, February 19, 1830.

THE following endorsement has been made upon the specification at the patent office.

“Improvement in the manufacture of paper, for which two patents have been granted to the said William Magaw, one dated on the 8th day of March, 1828, the other the 21st day of May, in the same year; both of which patents being hereby cancelled on account of defective specifications.” The new specification is as follows.

This improvement or discovery consists in the use of ley and its salts, in preparing straw, hay, or other vegetable substance, for the manufacture of paper, in the following manner, viz. To one hundred and twenty pounds of straw, or hay, take the ley procured from three or four bushels of ashes, or from fifteen to twenty pounds of the salts of ley, according to the quality; dilute it with a sufficiency of water to boil the straw or hay, which need not be all immersed at the commencement, as it will sink during the process of boiling. Boil the materials together until the vegetable matter and the knots become soft, or pulpy; or steep the materials in the solution several days until the same effect is produced; draw off the remaining liquid and rinse the materials to cleanse them from any dirt, or sediment, then grind them in the usual way, to be manufactured like rags into paper.

The petitioner claims as his exclusive improvement or discovery, the use of the ley, and its salts, and the mode of preparing the materials so as to render them fit for the manufacture of paper.

WILLIAM MAGAW.

Remarks by the Editor.—If straw had never before been used for making paper, its application to that use would undoubtedly present a legitimate claim to a patent; or if a particular mode of applying it to this purpose had been discovered and patented, an improved method would likewise entitle the discoverer to an exclusive privilege to use it. That Mr. Magaw's patent does not rest upon either of these circumstances, must, we think, plainly appear by a reference to what we have formerly said upon this subject. At page 416, new series, will be found the two former specifications, now surrendered, and a reference to a patent granted some years previously, both in France and England, for using the same material in the same manner. In our remarks upon Mr. Bomeisler's patent, page 415, vol. iv. we have also spoken fully upon this point.

As respects the surrender of the patents previously obtained, and the putting in of a new specification, we are at a loss to perceive what it is proposed to obtain by it in the present instance; all the difference which we see between the specification of May, 1828, and the present, consists in changing the proportion of the articles, and modifying the process by which they are used; but so slightly as not to have required a new specification; Mr. Magaw has judged differently, and his desire to make known that which he esteems the best mode of procedure, is praiseworthy. If, however, his claim was, in the first instance unfounded, as we believe to have been, what he has subsequently done cannot place it on a secure basis.

Specification of a patent for a composition called Leather Paper.
Granted to EPHRAIM F. and THOMAS BLANK, of the City of New
York, February 16, 1830.

THIS new and valuable invention or discovery, consists of the art of making a *paper* from the refuse parings or shavings of leather, which is peculiarly and admirably fitted for sheathing vessels; and which is believed to be superior to the sheathing paper, or leather, both of which are now in general use for that purpose. It may also (after suitable preparation,) be used for most of the purposes to which leather is applied, as the manufacture of patent leather, caps, pocket books, and for all kinds of book binding.

The mode of forming the patent *leather paper*, is similar to that of the manufacture of paper from rags. The shavings being ground, or beaten to a proper consistence, are put into a suitable mould, from whence they are taken to the press. The colour of this paper may be varied according to the quality of the shavings used, or by a chemical process. It may be brought to such a degree of fineness and whiteness as to be equal to the finest writing paper.

The subscribers claim the sole privilege of using their patent *leather paper* in the manufacture of *any article* to which leather or paper is applied.

EPHRAIM F. BLANK,
 THOMAS BLANK.

Remarks by the Editor.—The making of sheets from the ground parings or shavings of leather, has been frequently attempted, in the way above pointed out. Some years ago it was stated in the public papers that a manufacture of the kind had been established in Germany, and the manufactured sheets applied to various purposes. We have seen specimens of such sheets made in the United States, and have no doubt that the experiment has been tried by many of our paper makers. The sheets so made want that toughness which results from the organized animal fibre in the unbroken skin. By means of size and pressure, a very good appearance may be given to such sheets, but still they will bear the same relationship to leather which paper bears to cloth.

ENGLISH PATENTS.

Specification of a patent to WILLIAM NORTH, Surveyor, for an improved method of constructing and forming Ceilings and Partitions for dwelling houses, warehouses, workshops or other buildings, in order to render the same more secure against fire, July 4, 1829.

To all to whom these presents shall come, &c. &c.—*Now know ye, that my said invention is described and ascertained in the manner following, that is to say, my improved method of constructing and*

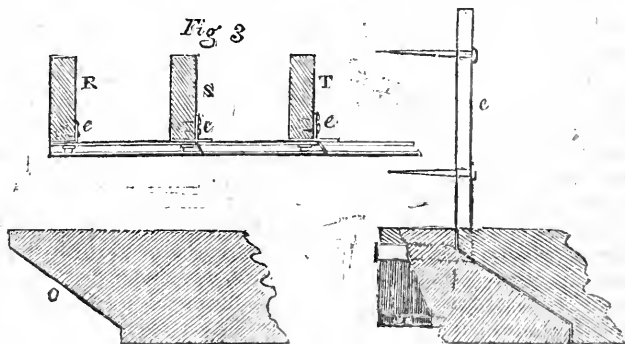
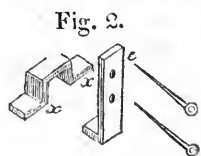
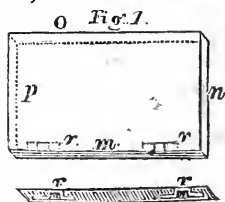
forming ceilings and partitions for dwelling houses, warehouses, workshops, or other buildings, consists, in applying, fixing, and retaining upon, or against the woodwork of such ceilings and partitions, certain flat tiles, which have been previously moulded, and formed of a composition which, when set and become dry, will sufficiently resist the action of fire.

Composition to make the tiles.—Take the dust of soft bath stone obtained from the chipping, and refuse small pieces made by masons in working such stone, grinding the same to powder by a suitable mill, of the kind called runners, on edges or rolling stones turned by a horse or other mill work; with the said dust of soft bath stone, mix half as much by measure, of Dorking quick lime, incorporating the lime and stone dust well together in a dry state; and to the mixture of quick lime and stone dust, add half as much by measure, of plaster of Paris, mixing the materials well together, and then beating up the composition with as much water as will give to the same the consistency of soft mortar, which, when well worked, is to be put into moulds and spread out in smooth layers therein, in the form of tiles, which if the materials are good and well mixed, will soon set hard enough to be removed from the moulds, and set up on edge to dry. The composition is therefore two parts by measure of Dorking lime, three parts by measure of plaster of Paris, and four parts by measure of dust of bath stone.

Moulds for forming the tiles.—These moulds are formed on the horizontal surface of a flat table or work bench, which is made very smooth, and long straight rails are fixed thereon parallel to each other, at such distances apart as to leave a clear place between them, equal to the intended length of the tiles, usually about twenty-four inches; other shorter rails are applied across between the long rails, their ends being fitted into notches cut in the long rails, the cross rails leaving clear spaces between, equal to the intended width of the tiles, usually fifteen inches; the thickness or height that all the rails rise up above the surface of the table, is equal to the intended thickness of the tiles, usually one and a quarter inches; each of the rectangular spaces thus bounded on four sides by the rails forms a mould, and the interior edges of the bounding rails are made to overhang on one side and one end, and to underhang at the opposite side and end of the same mould, in order to form the tiles with bevilled or rebated edges, that they may fit one to another by overlapping as hereinafter described. The inside of each mould is smeared with oil, and the composition being well mixed up to a consistency of soft mortar, is filled into the spaces between the rails; and certain iron staples, which are for the purpose of fixing and suspending the tiles as hereinafter described, are then imbedded in the soft plaster near to the edges of each mould; the staples are pressed down in contact with the boards of the table, but do not stand up high enough therefrom to reach through the thickness of the tiles within about one eighth of an inch; the composition must be well spread within the mould, and completely filled up to the edges of the rails with a plasterer's trowel, or other suitable tool, the upper surface being

worked very smooth therewith in order to give a finish to that side of the tiles which is to be downwards, if they are applied for a ceiling, or outwards, if they are applied for a partition; and if it be required to give the outsides of the tiles a finer surface, a thin layer of fine plaster may be spread over the same, before the mass of the tiles are set. If the lime and plaster are of good quality the tiles will soon set in the moulds, and then one of the long rails is taken up off the table, and all the cross rails are removed; and also by rapping upon the boards of the table with a hammer, in the spaces between the tiles, the jarring will cause the boards to detach from the undersides of the tiles, leaving them loose on the table, from which they may be removed and set edgeways to dry and harden ready for use. The oil which was applied upon the boards of the table, and the edges of the rails which form the mould, before the composition was filled in, by filling up the pores of the wood, facilitates the separation of the tiles from the boards and rails.

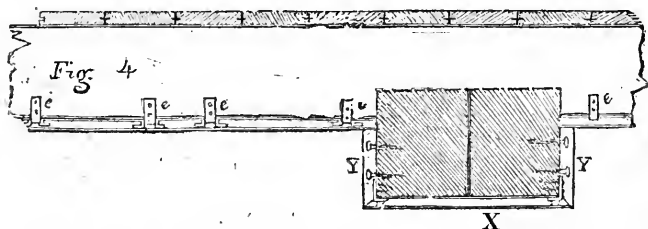
Fig 1 represents one of the tiles ready for fixing in its place to form a ceiling or partition, along two of its sides the edges *m n* overhang, and on the other two sides *o p* the edges underhang; in the longest of the overhanging edges *m*, two of the iron staples before mentioned were embedded at *r r*, at the time of moulding the tile; the claws or extremities *x x*, fig. 2, of each staple, being buried within the solid substance of the tile, so that the staples cannot draw out. The width of the tiles must correspond with the distance between the joists or pieces of quartering, or other woodwork forming the frame work for the ceiling or partition; and the tiles are to be applied against the woodwork, so that the sides of the tiles in which the staples are provided may correspond as nearly as may be with the edges of the joists or pieces of wood framing, as is shown in fig. 3; and a small iron hook, *e*, fig. 2, bent



like the letter *L* is inserted with its short end into each of the

staples, and then the longer end, applying against the sides of the piece of wood is fastened thereto by a nail, or two nails, if need be; and by the said hooked or L piece, the tile is fastened against the wood: the first row of the tiles which is thus fixed or applied may require staples at the two opposite sides of each tile, in order to apply four hooks to fasten each tile, as shown at r fig. 3; but when one row of tiles is thus securely fastened the overhanging edges of those tiles will support one edge of the succeeding row of tiles, whereby two staples and two hooks to each tile will be sufficient to fasten them securely in their places, as shown at s and t fig. 3; or instead of four staples and four hooks to each of those tiles, that are put up in the first row at r, the first edges thereof may be fastened by nails or screws, put through the thickness of the tiles into the wood behind or above the tiles; also the last row of tiles which is put up must be fastened by means of nails or screws, put through the thickness of the tiles into the wood, behind or above the same, and the heads of such screws or nails, being countersunk deeply into the thickness of the tiles, may be concealed by filling up with the composition whereof the tiles are made, or with plaster.

For forming the ceilings in which there are large and deep girders, as shown in fig. 4, those girders may be encased or enclosed with



tiles of a suitable width; those at the underside of the girder at x having four staples in each at the opposite edges, for the reception of as many hooks or L pieces to nail up against each side of the girder; the edges of the tiles should overhang or project beyond the width of the girder at each side, as much as to afford a lodgment for the lower edges of other narrower tiles x, which are applied at the sides of the girders, and may be fastened thereto by nails or screws put through the thickness of those tiles into the wood; the upper edges of the narrow tiles x fit up close beneath the tiles of the ceiling. The tiles in each succeeding row, or course, that is put up, are made to break joints, by putting up a half tile at the beginning of every other row or course next to the wall, or next to the girder, and a whole tile at the beginning of every intermediate row or course. The tiles, when dry, and ready to put up, are easily cut to any dimensions that may be required for those tiles, which are to fill up the spaces at the beginning and end of each surface in a ceiling or partition. The tiles having bevelled edges which overlap each other, leave no direct fissures through which flame or fire can penetrate, and by fixing one row of tiles with overhanging edges upon or behind which the underhanging edges of the next row are inserted, the latter

edges are thereby confined and retained in their places, the opposite or overhanging edges of the same tiles being fastened by means of the hooks and staples.

And my invention consists in the hereinbefore described method of fixing such tiles, viz.—by inserting staples into the tiles during the operation of moulding them, placing such staples in suitable positions to receive hooks or L shaped irons for the purpose of fastening the tiles to the wood work, and also in forming the edge of each tile in which there are staples overhanging, and the other or opposite edge overhanging, in order to interlock and fasten behind the adjacent edge of the tile next to it.

In witness whereof, &c.

Observations by the Patentee.—The fire proof ceiling here mentioned, is now in very extensive use at the St. Katherine docks, the ceilings over the whole range of quays being constructed on the principle described. Of the importance and great necessity for such an invention the numerous recent fires must convince the public. The tiles have been proved by the architect to St. Katherine docks, to be effectual in repelling the most raging fire.

Another advantage to be derived from the adoption of the ceiling above described, is, that it may be put up perfectly dry in the space of a few hours, whereas by the common mode of doing plastering, sufficient time must be allowed for the several coats to dry, which generally takes three or four weeks. It is much stronger and firmer than the common plastering, and will not crack through the shrinking or jarring of the timbers; this is sufficiently proved at St. Katherine docks, where immensely heavy casks are daily rolled and thrown upon the floors immediately over the ceilings.

[*Repertory of Patent Inventions.*]

To JOHN MORFIT, Bleacher, for an improvement on Retorts used by bleachers, and makers of oxymuriatic acid, or of oxymuriate of lime. Dated 15th December, 1828.

THE species of retort that Mr. Morfit prefers to use, is made of lead, of a cylindrical form, $4\frac{1}{2}$ feet in diameter, $1\frac{3}{4}$ inch thick at bottom, one inch thick at the sides, which are $1\frac{1}{2}$ foot deep; this cylindrical part is covered at top by an obtruncated cone of the same thickness as the sides, inclined so as at its top to rise two feet above the bottom of the retort; the upper flat part of this top is about two feet in diameter (according to the drawing,) and is inclosed round its edges by two concentrical vertical rims, about 3 inches high and $1\frac{1}{2}$ inch apart; and the cylindrical rim of a circular cover descends into the space between them, which, when used, has its junctures with the retort luted with a mixture of clay and water, and on its removal, affords a passage for cleaning out the whole.

The improvement on the retort, which is the object of this patent, consists in lining the internal surface of its sides with glazed tiles.

formed with that degree of curvature necessary for their contact with them, and having one of their upright edges grooved, and the other formed with an angular projection, so as mutually to clasp and adhere to each other, when set up in their places. These tiles the patentee directs to be made of the clay used for fire bricks, and glazed in the usual manner employed by potters; the crevices of their joints, when arranged in the retort, and that between them and the sides of the latter, are to be filled with powder made from the tiles by pounding or grinding. The dimensions of the tiles are not mentioned, but can be easily varied according as circumstances may direct; as may also the size and form of the retorts. The use of this improvement, is, to prevent the corrosion of the internal surfaces of the sides of the retorts, which is observed to take place when they are used for the purposes mentioned; and which are intended, by means of the glazed tiles, to be defended from the action of the oxy-muriatic acid.

The retorts when at work, are suspended in brick work at a convenient height, by rims that project from the upper edges of their cylindrical bodies for this purpose: and into the hollow spaces left beneath them, and round about their sides, steam, or strongly heated air, is then admitted, to cause, by its high temperature, the oxy-muriatic acid to pass over from the materials placed within them, into receptacles of the usual construction.

Obs.—The above contrivance seems one of considerable utility, and which may be also applied beneficially to the protection of retorts for the distillation of other acids that act on them, as well as that mentioned. We, however, have to object to the glazing directed for the tiles, being that *commonly* employed by potters, or in other words, the common glazing made by means of powdered galena, or lead ore; as most acids will act on it more or less; and instead of it, we recommend that the species of glazing employed for stoneware, or some other equally unassailable by acids, be used for these tiles. [*lb.*

To CHARLES TURNER STURTEVANT, *Soap Boiler, for certain improvements in the Process of manufacturing Soap.* Dated May 26, 1829.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Charles Turner Sturtevant, do hereby declare the nature of my said invention to consist in a process whereby I am enabled to make pure alkaline lees unite with animal or vegetable matter in the soap copper, which therefore enables me use caustic alkalies instead of the crude alkalies, such as barilla, kelp, and the like, now in use for that purpose; thereby avoiding the residuum which is used in the process of black ash making, and which causes much waste of animal matter; and in further compliance with the said proviso, I, the said Charles

Turner Sturtevant, do hereby describe the manner in which my said invention is to be performed, as follows: that is to say, I put into the copper, in the first instance, a small portion of soap and water, and mix them well together, so as to form a saponaceous compound, to which I add a small quantity of tallow or fat, or oil, as the case may be, mixing it with compound, and adding thereto as much caustic soda lees as will be taken up by these materials without separating. In this manner I continue adding animal or vegetable matter as aforesaid, and caustic soda lees till the copper is full, gradually increasing the fresh doses of animal or vegetable matter and alkali in proportion as the quantity of matter in the copper accumulates, keeping the mixture well roused or stirred during the whole of the process; when this is accomplished, it is moulded in frames in the ordinary way. The best strength for the caustic soda lees I believe to be about one thousand two hundred and sixty specific gravity, and the temperatures used in the boiling may be the same as heretofore adopted; but I recommend the use of smaller coppers, and of an oblong shape, capable of containing from two to four tons, and I prefer their being heated by steam.

Now whereas I claim as my invention the following improvements, that is to say; first, using pure caustic alkaline lees in the soap copper instead of the lees now in use, thereby doing away with the residuum aforesaid; and, secondly, commencing the operation of boiling with the saponaceous compound aforesaid, and adding animal or vegetable matter and caustic alkali thereto in manner hereinbefore described till the copper is filled; and such my improvements being, to the best of my knowledge and belief, new, and never before used within that part of his said majesty's United Kingdom of Great Britain and Ireland called England, his said dominion of Wales, or town of Berwick-upon-Tweed, I do hereby declare this to be my specification of the same; and that I do verily believe this my said specification doth comply in all respects fully, and without reserve or disguise, with the proviso in the hereinbefore in part recited letters patent contained, whercof I do further claim to maintain exclusive right and privilege to my said invention.

In witness whereof, &c.

Observations by the Patentee.—In order to give the general reader a correct idea of the nature of the improvements, for which the above patent has been obtained, it will perhaps be convenient to say a few words upon the ordinary method of soap making. The composition of soap is well known to consist of animal or vegetable fat, soda and water in certain definite proportions. Although this fact has been well known, yet soap has never been made by uniting its constituent principles in a direct manner; but, in order to accomplish the combination, the crude alkaline lees obtained from barilla, kelp, &c., previously rendered caustic by an addition of quick lime, are boiled together with the fat in large cauldrons or coppers. As the lees contain considerable quantities of neutral salts and carbonate of soda, a very large quantity are requisite to saturate the fat, which renders

it necessary to perform the process of several operations or boilings. The lees, after having imparted their free caustic alkali to the fat, are drawn from the copper, and are then termed spent lees; they, of course, consist of the neutral salts and carbonate of soda, with a portion of the animal fat held in solution. In order to recover their alkaline parts, the spent lees undergo a process termed black-ash making, but which it is here unnecessary to describe; it is, however, an expensive process, and exceedingly offensive. On this account it is dispensed with in several manufactories; the spent lees are sold for a very trifling consideration, and in other cases even thrown away. Although the neutral salts form no part of the composition of soap, yet, according to the present method of making it, their presence in the lee is absolutely necessary; and in some cases where alkalies are employed, which either do not contain them at all, or in too small quantities, common salt is employed to supply the deficiency.

By referring to the preceding specification, it will be seen that, instead of requiring the presence of neutral salt in the lees, they are divested of that and all other extraneous matter, pure soda only being used, thereby rendering it totally unnecessary to put into the copper any thing that does not enter into the composition of the soap.

The advantages of this method will be easily perceived by those engaged in the manufacturing of soap; for, as there are no spent lees to withdraw from the copper, there can be no waste either of alkali or tallow, nor can there be any black-ash making; besides which, the principal causes that render soap-works so generally obnoxious are removed; and the process considerably shortened.

It is affirmed that this method of soap making is applicable to all the various sorts at present in use, and that the soap so made will suffer in no respect by comparison with those manufactured in the ordinary way.

The inventor flatters himself that as a pure soda can be most economically procured from the British alkali obtained from the decomposition of salt, a great extension of this article of domestic manufacture will prove a result of his improvements. [*It.*]

FRANKLIN INSTITUTE.

Twenty-fifth Quarterly Meeting.

The twenty-fifth quarterly meeting of the Institute was held at their Hall on Thursday evening, April 15, 1830.

JAMES RONALDSON, president, in the chair.

The minutes of the last quarterly meeting were read and approved.

The quarterly report of the Board of Managers, and also of the treasurer, were severally read and accepted, when, on motion it was resolved, that the report of the Board be referred to the committee on publications, to publish such parts as they may deem expedient.

The chairman of the Board of Managers read the following resolution, postponed at their last meeting, viz.

Resolved, that it be recommended to the Institute, at their next

quarterly meeting, to cause the rooms recently occupied by the United States court, to be fitted up as a reading room for the use of the members, and to cause the library, minerals and models, to be arranged therein, and that they be requested to adopt measures for raising funds to defray the expenses of said arrangement.

Whereupon, the following resolution passed, viz.

Resolved, that the recommendation of the Board of Managers, that the rooms in the Hall of the Institute recently occupied by the circuit and district courts of the United States, be fitted up for a reading room for the use of the members, and for the library and the cabinets of minerals and models, be adopted.

Resolved, that a committee of fifteen members be appointed with authority to collect subscriptions for the purpose of fitting up the rooms.

Resolved, that said committee be instructed to have the rooms prepared, and give public notice thereof to the members.

Whereupon, the following gentlemen were appointed on the committee.

Messrs. Samuel V. Merrick,	Samuel J. Robbins,
Abraham Miller,	M. W. Baldwin,
James Hogan,	James Baker,
John S. Warner,	David S. Brown,
Thomas Fletcher,	William S. Perot,
William A. Blanchard,	E. W. Keyser,
John W. Henry,	Isaiah Lukens.
George W. Smith,	

Resolved, that the above committee act in conjunction with the library committee, and prepare such rules for the government of the reading room and management of the library, as they may deem expedient, and report to the next quarterly meeting of the Institute.

Resolved, that the committee on publications be instructed to exchange the Journal of the Institute for periodicals and newspapers, as extensively as possible.

JAMES RONALDSON, *President.*

ISAAC B. GARRIGUES, *Recording Secretary.*

Twenty-fifth Quarterly Report of the Board of Managers of the Franklin Institute.

THE Board of Managers, in compliance with the directions of the constitution, submit a report of their transactions for the first quarter of the present official year.

Of the various enterprises that have been undertaken by the Institute, the experiments for the determination of the value of water as a moving power, hold the first rank, whether we consider the importance of the subject to the country, or the credit that its successful determination will obtain for the society. The immense capital that is invested in manufactories, the machinery of which is

moved by water, the little that is known of the most economical and advantageous mode of applying and estimating the value of this power, would justify the hope that ample funds could be procured. The consideration that in Europe, with all the advantages of large capital, profound science, and royal patronage, so little has been done to determine this question, should encourage the society to persevere in their arduous undertaking, and by prosecuting it to completion, secure to the country the merit of determining this important subject. The committee entrusted with the prosecution of these experiments have recommenced their labours with zeal, and have nearly completed a series of very judicious and ingeniously contrived experiments on a wheel 20 feet in diameter. They have already arrived at very interesting results, which will shortly be laid before the society. But while their success thus far gives them every encouragement to persevere, they will be unable to carry the experiments to the contemplated extent unless further funds shall be placed at their disposal. The mere statement of this fact will, it is hoped, induce those interested in the subject to contribute the necessary funds.

Since the last report, an arrangement has been made with the Marshal of the United States for this district, by which the rooms lately occupied as a court room and offices, have been relinquished to the society. This arrangement places at the disposal of the society an elegant and spacious room, admirably fitted for a library and reading room, and for the monthly and quarterly meetings of the Institute. Resolutions of the Board are herewith submitted, recommending that these rooms should be fitted up for the above purposes, and that the society should take such measures as may be necessary to defray the expenses thus incurred. It cannot be doubted that great benefit will be derived from presenting to the intelligent artisan and mechanic, the use of a well furnished library, and cabinets of models and minerals, and affording him an opportunity for associating daily with gentlemen of all professions, willing to communicate the knowledge they have acquired, and anxious to learn from others that which they are not fortunate enough to know. The Managers of the Institute appeal with confidence to the members for means to carry these plans into effect, being convinced that they will advance its prosperity and place it in that elevated rank amongst its fellow labourers in the field of useful knowledge to which it is entitled, by the general utility of the objects of its attention. In the library and reading room, the Board look for a revival of the spirit which actuated the members of the Institute in the early part of its existence, when the great number of contributors warranted the commencement of all the objects embraced in its plan.

We are in possession of the elements of a library, and a cabinet of models and minerals, which we hope will be enlarged by the liberal contributions of the members, and soon rendered extensively useful to the institution.

The courses of instruction in the lecture room and drawing school, for 1829-30, have terminated, and the satisfactory evidence of their

just appreciation, which has been afforded by the regular attendance of numerous classes, cannot fail to convince the most incredulous of the benefits which flow from these departments of the Institute. To the kindness of Peter A. Brown and James R. Leib, Esqrs. and Dr. John T. Sharpless, we are indebted for a series of highly interesting volunteer lectures, and it is hoped that the good example which has been given by these gentlemen will cause many of the members of the Institute to cast their share into the treasury of useful knowledge.

To the exhibition announced to be held in September next, the attention of the members is ardently desired as a means of promoting not only the interests of the institution, but of exhibiting to the world that we are still engaged in fostering the useful arts. The list of premiums embraces a number of articles for which we are now dependant on foreign countries, and to the production of which both our climate and our manufacturers are fully competent.

All which is respectfully submitted.

S. V. MERRICK, *Chairman.*

WILLIAM HAMILTON, *Actuary.*

Monthly Meeting.

THE stated monthly meeting of the Institute was held at their Hall on Thursday evening, March 25, 1830.

Professor ALEXANDER DALLAS BACHE, was appointed chairman.

The minutes of the last meeting were read and approved.

The following donations were presented, viz.

Major N. Ware presented *Treadgold on Rail-ways.*

Mr. Judah Dobson presented *The Mechanic's Assistant.*

Thomas P. Jones, M. D. presented *The Speeches of Daniel Webster, delivered before the Senate of the United States, on the 20th and 26th of January, 1830.*

The Speech of Mr. Hayne, delivered 21st of January.

The Speech of Mr. Sprague, delivered 3d of February.

Mr. William Hamilton presented *A Map of the City of London.*

Mr. Rufus Tyler presented *A Large Concave Mirror.*

Various Specimens of Minerals were added to the cabinet by donations from Messrs. William Pendleton Orrick, of Reading, Pa. Gratz Etting, Centre county, Pa.; George Merrick, City of Philadelphia; Samuel B. Fales, City of Philadelphia; Isaac Doolittle, Bennington, Vt.

The corresponding secretary laid on the table the following works received in exchange for the Journal of the Institute, viz.

The North American Review, for January, 1830.

The American Quarterly Review, for March, 1830.

The American Journal of Education, Nos. 42, 43 and 44.

The American Farmer, Vol. 11.

London Journal of Arts and Sciences, for January, 1830.

The London Mechanic's Magazine, for November and December, 1829.

The London Journal of Arts and Register of Patent Inventions, for January, 1830.

Gill's Technological and Microscopic Repository, for Jan. 1830.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, for October and November, 1829.

Annales de Chimie et de Physique, for October and November.

Journal Universel des Sciences Médicales, for October.

Recueil Industriel, for September.

Bibliothèque Physico-economique, for November and December.

The committee on inventions presented a report on Mr. William Woodworth's machine for planing, tongueing, and grooving boards, &c., and also a report on Mr. Benjamin Tanner's improvement for preventing alterations in bank checks, &c., styled "Stereograph Plates," which were severally read and accepted.

Professor Franklin Bache submitted a paper in reply to the query, what is the rationale of the action of hydrogen gas on sponge platina, as discovered by Doebereiner? which was read, and on motion referred to the committee on publications.

A communication was read containing the following queries.

Suppose an iron pot be dropped into the sea, with its mouth downwards, and one cubic foot of inclosed air by its buoyancy prevents it from sinking; the addition of one pound of the same metal places the vessel in an equilibrio at the surface, but two pounds being added it sinks.

1st. If it descends in an upright position so as to prevent the escape of air, and it be not intercepted by the bottom of the sea, at what depth will it become stationary?

2nd. At its Stationary depth will the removal of the extra two pounds weight cause the vessel to rise again to the surface? On motion the above was placed on the list for discussion.

Extract from the minutes.

ALEXANDER DALLAS BACHE, *Chairman*.

ISAAC B. GARRIGUES, *Recording Secretary*.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks on Mr. J. P. ESPY's communication in the number of this Journal for February last, relative to the power required to Propel Carriages on Rail-roads, compared with that for moving boats on Canals.

IN treating on such subjects of general and immediate interest as those in the article referred to, great care is necessary least any thing should be said calculated to lead to an incorrect conclusion. Although the article in question possesses much merit from the general soundness of the principles advanced, yet some important circumstances appear to have been entirely overlooked by the writer, which it is my purpose to bring into view. Mr. Espy has shown that if the carriage invented by Mr. Winans be used, the tension of

the rope by which it shall be drawn will not exceed one pound to a thousand pound load, and that it will not be increased by any increase of velocity; that this tension will move the same weight in a canal at the rate of one and six-tenths mile per hour; that a double velocity, or three and one-fifth miles per hour will give four times the resistance, increasing the tension of the rope from one to four pounds; and finally, at 32 miles an hour the tension will be 400 pounds. He then gives the following example: "suppose the power to be estimated by the quantity of coals consumed in transporting a given weight with the various velocities mentioned above, it will be found, if the velocity is one mile and six-tenths an hour, the quantity will be the same on the canal as on the rail-road; whereas, if the velocities are 16 miles an hour, the quantity consumed on the canal will be 100 times greater for every mile and one-sixth, while that on the rail-road will remain exactly the same. Now when it is recollected that a very great velocity cannot be obtained at all on canals, and that a velocity of 20, or even 30 miles per hour, can be obtained on a rail-road with no greater expenditure of coals per mile," (or what is the same thing, the expenditure will be the same in the same distance whether performed in equal or unequal times,) "than would be required on a canal with a velocity of $1\frac{6}{10}$ mile per hour, we may predict with the greatest confidence, that canals, in a few years, will be entirely supplanted by rail-roads."

This paragraph would lead the reader to suppose that the writer intended to convey the idea, that if half a pound of coals would move a ton of goods by canal one mile at the rate of one and six-tenths mile an hour, that half a pound of coals will move a ton of goods by rail-road one mile, when going at the rate of 30 miles an hour. If this be his meaning then I think he is in error, inasmuch as all the weight to be moved cannot be *goods* in either case, nor can the goods bear the same proportion to the engine that can move itself and the goods at the rate of 30 miles an hour, as the goods bear to the engine that can move itself and the goods at the rate of one and six-tenths mile per hour on the canal, or on the rail-road.

Example.—Suppose an engine and its appurtenances which weighs 4 tons, will, in addition to its own weight, draw a train weighing 80 tons, the whole weight will be 84 tons, moving at the rate of $1\frac{6}{10}$ mile an hour with half a pound of coal per mile, for each ton; the distance, 30 miles, will be performed in 18.75 hours with 1860 lbs. of coals. Then if this engine requires 18.75 hours to generate and apply a quantity of power that can overcome the whole resistance of 84 tons in 30 miles, is it reasonable to expect it to do as much in one hour? the answer certainly must be no; it will require an engine whose power shall be 18.75 times greater, and, consequently, 18.75 times heavier. Thus the weight of the first engine, $4 \text{ tons} \times 18.75 = 75$ tons, it then follows that the load must be diminished as much as the weight of the engine is increased, thus $75 \div 9 = 8\frac{1}{3}$ tons, hence the weight of the goods and car on which they are laden can be no more than $8\frac{1}{3}$ tons. If the weight of the car be 3 tons, we have 6 tons of goods conveyed 30 miles with 1260 lbs. of coals = 210 lbs.

to the ton. In the first case, the goods, and cars on which they were laden, was 80 tons, from which take one-third; for the weight of the cars we have 53.2 tons of goods conveyed 30 miles with 1260 lbs. of coals = 23.6 pounds per ton. It may be proper here to remark, that the weight of canal boats is much less in proportion to the load they carry than that of rail-road cars to their loads.

The operations of locomotive engines on straight and level rail-roads, can be estimated with more certainty than on roads that are curved and have frequent ascents and descents in their line; the power of the engine being always equal in equal times, the velocities at which they will move may be expected to vary as do the resistances, and the sum of power required to move a load 100 miles will be much greater on a curved, and undulating, than on a straight and level line.

Example: suppose the resistance to a locomotive engine and its train on a level road to be one pound to one thousand, which arises chiefly from friction of the axles; if they encounter an inclined plane of one foot rise in 200 feet, on which the opposing gravitating force of the train will be as the perpendicular ascent is to the length of the plane, viz. 1 pound to every 200 pounds, or 5 to 1000, making the whole resistance 6 pounds to 1000; then suppose the velocity on the horizontal plane 20 miles an hour; when it ascends the inclined plane the velocity will diminish as the resistance increases, viz. from 20 to 3.3 miles an hour, which would be performed without any increase of elastic force of the steam or delay at the foot of the plane, provided the connexion of the engine with the carriage be so arranged, that as the resistance of the road increases, the gear of the engine by some suitable contrivance may be so altered, as that an uniform resistance will oppose the motion of the engine, which thus circumstanced, would remain equable, whatever may be the retardation of the carriage by encountering an ascending plane; but without an arrangement by which this would be effected, the velocity of the carriage will be more variable than the resistances; and the strength, and consequently the weight of the engine as compared with the goods, must be much increased.

Example: when a train weighing 80,000 pounds, engine included, arrives by a level road at the foot of an inclined plane, at a velocity of 20 miles per hour, the force of the steam, say 50 lbs. to the inch, equals the resistance on the level road, viz. eighty pounds, it must be evident that this force cannot overcome 480 pounds, which is the resistance on the inclined plane; consequently, were it not for the momentum of the moving mass, the whole would suddenly come to rest, until the force of the steam shall have time to increase from 50 to 300 pounds to the inch, which would then be equal to the resistance, when the carriage will be moved to the top of the plane at the rate of 3.3 miles per hour: should the next section of the road descend more than one foot in 1000, the carriage will descend by gravity alone, hence all the accumulated steam, as well as that generated while passing down the plane, must be lost, should the next section of the road be level, as no more than 50 pounds pres-

sure can then be used; it is also plain that the engine and boiler must be five times stronger, and consequently much heavier than would be necessary if the whole road was level; hence it follows, that the power required to travel a given distance on an undulating road will exceed that necessary in the same distance on a level road, as much as would be required to raise the whole train perpendicularly, to a height equal to all the elevations in the road taken together, whether the termination be at a higher or lower level than the commencement. As some conditions of a descent may occur, that will in part compensate an ascent, the above rule may not hold good to the full extent. Although in passing from one level to another when travelling upon canals, detention is unavoidable, the power employed is provided at the erection of the canal itself, and neither requires coals or horses to effect the purpose. I am by no means opposed to rail-roads, but on the contrary anticipate their affording great facilities in transportation, and believe that they will do so, even where a moderate speed only, say 5 miles an hour, may be necessary; at the same time, I am compelled to differ materially from Mr. Espy in my estimate of the amount of advantage that they will be found to afford over canals, inasmuch as I think that the speed at which the expense of the two modes of travelling will be found to be equal, will be between 3 and 4 miles instead of $1\frac{6}{10}$ miles an hour, as he supposes, and consequently that travelling at any speed less than 3 miles an hour, will be cheaper by canals than by rail-roads; and therefore that canals should not be abandoned, until rail-roads shall, in practice, be proved to be superior to them for all general purposes.

Abstract of a memoir upon the Bones procured from Butcher's Meat.

By M. D'ARCET, Member of the Academy of Sciences.

WE propose, in this memoir, to call the attention of the administration, and to enlighten public opinion upon the use of the gelatine of bones, considered as an alimentary substance. The long and difficult investigations which we have undertaken, with this view, since 1812, have enabled us to trace to its foundation the economical question; and we are inclined to believe, that in a few years, bones, so rich a source of nutritious matter, will take the rank they so well deserve among the animal substances employed for the nourishment of man.

We submit this work to the judgment of the enlightened persons who devote themselves to the relief of the indigent classes. We are desirous that they should approve of the result of our labours; and we hope that they will give us their support, in order that we may obtain the useful objects that we have in view.

Bones ought to be divided into two classes. Those which are compact, flat, or cylindrical, contain very little fat. They are sold at very high prices to the turners, button makers, and fan makers: they ought to be laid aside and kept for these purposes.

The other bones which remain after these have been selected, and among which are found the spongy heads of the large bones, and the

end of the flat bones, are those which ought to be employed for the alimentary substance. Numerous analyses have shown us that these bones when dry contain in 100 parts, about

Earthy substance,	- - - - -	60
Gelatine,	- - - - -	30
Fat,	- - - - -	10

The heads of the large bones contain as much as 50 per cent. of fat. It is remarked that the bones of mutton and the bones of roast meat give often very rancid fat, or fat smelling of tallow, and that they ought to be laid aside and managed separately.

One hundred kilogrammes (220 lbs.) of bones contain 30 kilogrammes (66 lbs.) of gelatine; and since ten grammes (.353) of gelatine are sufficient to animalize a half litre (about 1 pint) of soup, at least the best household soup, one kilogramme (2.2 lbs.) of bones is sufficient to prepare 30 basins of soup of one demi-litre, (1 pint); but one kilogramme (2.2 lbs.) of meat will only furnish 4 basins of soup, from whence it follows, that the equal weight of bones supply to water seven times and a half more animal matter than meat.

One hundred kilogrammes (220 lbs.) of butcher's meat contain about 20 kilogrammes (44 lbs.) of bones. This quantity of meat making 400 basins of soup, and the 20 kilogrammes (44 lbs.) of bones making 600, we see that by extracting all the bones procured from the given quantity of meat, three basins of soup can be made with the bones, while the meat and the bones united actually give but two.

With the bones contained in the meat consumed in the single department of the Seine, we could prepare more than eight hundred thousand basins per day.

The gelatine of the bones can be extracted by submitting them whole to the action of steam; but the operation would be tedious, even though there were no risk of changing the nature of part of the gelatine in making use of the steam strongly compressed, and it is better to bruise them: but some precautions are necessary. The bones must not be broken by redoubled blows, because they contract thereby a very disagreeable empyreumatic smell. They must first be soaked as much as possible, and then broken by a single blow, in passing them through two grooved cylinders, or under a mallet sufficiently heavy. On a small scale, we may make use of a dish and mass of wood, both covered with an iron plate cut into diamond points. In either, care must be taken to soak the pieces of bones which are to be broken again, in water. They ought to be used immediately after, or else kept plunged in fresh water, or what is better, water almost saturated with salt. The bones subjected a short time after to steam strongly condensed to a dry heat of 130° to 140° break very easily; but this process is subject to the inconveniences of detaching part of the fat, and it should only be employed upon those which do not contain any fat, or upon old and dirty bones.

The preservation of bones as an alimentary substance, is of the highest importance, as they easily putrify.

A portion of the gelatine changes into ammonia, and this, by combining with the gelatine not decomposed, takes away its property of turning into jelly by cold, and makes it soluble in cold water.

Various methods of preservation have been tried. In all cases we should begin by depriving the bones of the fat, or else they acquire in time a rancid smell, which renders them useless.

The broken bones boiled in a copper with water furnish a great deal of fat, but they still retain enough to turn rancid. It has been proposed to remove the remaining fat, by saponifying it with soda, but the success has not been complete, the gelatine is often altered, and retains a disagreeable smell of soap, the salting which can be applied over the first bones is preferable, if on a great scale it is not too expensive, and if the products are as agreeable as in the fresh state.

The method which appears to succeed best, is that for the preservation of meat, invented by M. Plowden, which consists in immersing the meat in a strong solution of the juice of meat, or of gelatine, and then drying it in the open air. I took a solution of gelatine containing about 20 per cent. of dry gelatine: I heated it to 80° or 90° (about 170° or 190° Fah.) and dipped into it, several times, the clear bones, broken into small bits and deprived of their fat. The bones when taken out of the solution of gelatine are put to dry in the open air, and then treated once or twice in the same manner, to increase the thickness of the layer of gelatine. It is followed by a perfect desiccation in a stove of 20° or 25° (70° to 80° Fah.)

The extraction of the gelatine of bones is yet but imperfectly known, and demands particular attention. It appears that the first attempt was made by Papin, who proposed, in 1681, to employ condensed steam for this purpose; but the gelatine obtained by this process was almost always altered, had a disagreeable empyreumatic smell, and was no longer a jelly.

The boiling rasped bones with water under the pressure of the atmosphere, has not the same inconvenience, but the operation is long and expensive, and the bones do not give out nearly the quantity of gelatine which they can furnish.

About 15 years ago, I discovered the art of extracting the gelatine of bones by means of acids. The happiest results were obtained: and if the direction of it had been placed in able hands, there is no doubt that the preparation of gelatine as an alimentary substance would, since that time, have acquired the greatest extension.

In considering about the same period the inconveniences of Papin's method, I was enabled to overcome them by modifications. The process which appears to me the most advantageous, is that of exposing the bones to the action of steam having a weak tension. Its success is caused by the steam condensing in the pores of the bones; it expels the fat and then dissolves successively all the gelatine. This is merely the repetition of an old pharmaceutic process now forgotten, but which may be found quoted in the *Pharmacy of Baumé*, p. 108, edition of 1790.

The presence of fat in the bones makes the process complicated. This fat becomes acid by the carbonate of lime which forms an insoluble soap, which prevents the solution of the gelatine. It follows in consequence that the bones are deprived of this fat before the gelatine is separated.

We come to this result by boiling the broken bones in water in a

copper uncovered, as is usually done, or by exposing them first only to the steam not condensed. The extraction of the gelatine by steam little condensed requires at least 4 days to complete it. The broken bones deprived of their fat or not, are placed in a cylindrical basket of tinned iron-ware filling almost entirely the capacity of a metallic cylinder in which it is held suspended.

This being closed, steam of a weak tension is introduced which melts the fat, and dissolves a little of the gelatine. We then increase the tension. The liquids are drawn off in a cylinder by means of a cock placed at one end; the gelatine solution is obtained more or less concentrated according to the rapidity of the condensation of the steam, and the smallness of the bones. The following are the principal circumstances which it is necessary to observe. 1st. The bones ought to be broken into thin pieces; they should be bruised if they are thick and full of fat, and be drained the more rapidly, or at a lower temperature.

2nd. The broken bones ought to be deprived of their fat previously, either by means of boiling water in a common boiler, or else in the cylinders, introducing steam not condensed, or perhaps water heated by means of steam.

3d. The steam of the water ought to be so much condensed, and the period of the operation so much more prolonged in proportion as we would wish to obtain the gelatine pure, and of a strong jelly.

4th. There would be more economy in preparing the gelatine solution much concentrated, and then bringing it back to a convenient strength, by mixing it with hot water. To obtain this result, care must be taken to moderate the condensation of the steam in the apparatus.

5th. The degree of tension which best suits the steam is that of 9.60 millimetres of mercury, which corresponds with a temperature of 106° to 107° (223° to 225° Fah.) The cocks placed upon the pipes which conducts the steam into the apparatus, allowing the tension to be varied at will, and to be maintained uniformly.

The solution of gelatine comes from the apparatus perfectly clear, if it does not rush out impetuously with the steam. As it is without flavour it can be used as an alimentary jelly, by the addition of sugar or aromatics, as convenient. Reduced till it contains only 2 per cent. of gelatine, it is as much impregnated with animal matter as the best household soup, and may be used either to animalize food of a vegetable nature, or as a substitute for soup, after being salted, coloured, and aromatized. The salt which gives the most agreeable flavour, according to the interesting remarks of M. Braconnot, is a mixture of 70 parts of marine salt, and 30 of chloride of potassium. Evaporated when it comes out of the cylinder, after being seasoned with herbs or the juice of meat, we obtain either cakes of gelatine or cakes of soup. Their uses are numerous, and it is easy to perceive all the advantages of this most salubrious alimentary substance. The fat contained in the bones turns into soup very quickly when it is exposed to the action of compressed steam. It is advantageous to take off the fat with boiling water, or even at a lower temperature, for the fat is much better if exposed to a lower heat. The bones

give out their fat very quickly in steam a little condensed; but the quantity of fat changed into soup, and which remains in insoluble combination with the lime, rises to 4 or 5 per cent. of the weight of the bones used, and such a loss ought to be avoided.

An apparatus composed of four cylinders is established at the Hospital de la Charité. Each cylinder is 1 m. ($3\frac{1}{3}$ feet) in length and 0 m. 333 ($1\frac{1}{3}$ foot) in diameter, and contains about 40 k. (80 lbs.) of bones, furnishing about a thousand basins of soup a day. The importance of the work of M. D'Arcet has induced us to give an abstract of the principle part of it, for further details we must refer our readers to the original memoir printed in the *Annals of Industry* for Feb. 1829. [*Brande's Quart. Journ.* Jan. 1830.]

In the application of the method just given at the Hospital de la Charité, on a large scale, practical difficulties were encountered, which have been obviated by the author in the manner explained in the following note from the *Recueil Industriel*, September, 1829.

The use which has been made of the apparatus already described at the Hospital de la Charité has led to an improvement which I regard as very useful; I hasten to publish a note on this subject in order that those using the apparatus in question may avoid the difficulties which I encountered while using cylinders of a great capacity.

I said that the quantity of water condensed in the cylinders might be varied by giving them a considerable surface, by depriving them of polish, and by baring the surface, or by cooling them in any other suitable way. Since then experience has shown me that the steam must be condensed near the axes of the cylinder, and not at their surfaces; I have applied a method of so doing to the apparatus at the Hospital de la Charité, which has succeeded. This improvement is as follows.

I bring cold water into each cylinder above the bones and in the middle of the cage which contains them; this water which flows from an elevated reservoir, comes drop by drop, and only in a sufficient quantity to produce with the water from the steam condensed in each cylinder precisely the number of rations of the gelatinous solution which the apparatus should furnish. This water reaching the surface of the bones which are raised at the temperature of 106° (223° Fah.) is soon warmed, it mixes with the water from the condensed steam, trickles through the bones, dissolving the gelatine as fast as it becomes soluble.

The pipe through which cold water is introduced into the axis of each cylinder is provided with a stop cock to regulate the quantity of water delivered.

On various Improved Pastes and Lutes. By THOMAS GILL, Esq.

Bookbinder's Paste, of Wheaten Flour and Alum.—The bookbinders are in the habit of making a considerable quantity of paste at once, and it takes a long time to incorporate the wheaten flour and the water together, in the usual manner of doing it; Mr. W. H. Kelly, our bookbinder, has, however, greatly shortened this time,

by adopting the following improved method. He first mixes the flour with cold water, to the consistence of thick batter; then, having a measured quantity of water boiling hot, in a tea kettle, in which a proper quantity of alum had been dissolved, by putting it into the water cold, and boiling it, he adds a little of this boiling alum water, by degrees, to the batter, stirring it well in, till he sees the effect it has produced on the flour, by a change in its appearance, when he suddenly pours the remainder of the boiling water into it, and also stirs it well all the while. In this way he soon makes the whole into paste; whereas, on the old plan of mixing it with cold water, and then boiling it, it occupied a whole day in breaking down the lumps which formed in it.

Lute, or Paste, of Albumen and Wheaten Flour.—The Editor lately found an ingenious copper-smith fitting together the inside joints of a distilling apparatus, by putting between the shoulders of them, stout hempen cloths, coated on both sides, with a thick mixture of wheaten flour and the whites of eggs (albumen,) made in the cold. In this judicious way, and without tainting the flavour of the alcoholic liquors, to be distilled in the apparatus, he employed a lute, which, instead of dissolving in the hot vapours, on the contrary was hardened by them. He employed a thick mixture of white lead ground in oil, to coat the exterior of his joints as usual.

The late Mr. Samuel Varley's Chemical Lute.—This consisted of wheaten flour, mixed with cold water, to which he added a portion of common salt. On applying a little of this lute, either to close the joints, or to stop the issue of vapours in distilling, the heat instantly acting upon the flour, changed it into a thickened paste, which had the desired effect. As, however, it might have been difficult to unlute the apparatus, after the operation was finished, so the salt was added to the lute, by way of introducing water into it, to soften it.

Paste of Wheaten Flour and Rosin.—A German manufacturer of ladies' work boxes, jeweller's trays, &c., was in the habit of lining them with morocco leather, velvet, or paper, with a paste composed of wheaten flour mixed up with water, and boiled; and whilst boiling, he incorporated a quantity of black rosin with it, which greatly improved its strength, and prevented it from being so easily affected by moisture. He finished it by straining it through a coarse cloth, and thus removed all the lumps in it.

Paste of Wheaten Flour and Wax.—A Mr. Mayhew informed the Editor of this improved paste, many years since, and which he made in the following manner. After boiling a mixture of wheaten flour in water, to form a paste as usual, he stirred a piece of wax candle round in it a few times, and which, mingling with the paste, greatly improved its binding quality. The Editor made some of it, and found it to have acquired a saccharine taste, from the union of the wax with the flour.

Paste of Bean Meal.—Mr. Boyle Godfrey, in a chemical work published by him many years since, says, that a paste composed of bean meal and water, may be usefully employed in closing letters, and that such closures cannot possibly be loosened by directing the

steam of boiling water upon them, as would be the case when the ordinary wafers were so treated.

Clay's Paste, of Wheaten Flour and Gelatine.—The paste by which the sheets of whited brown paper were so firmly held together, in the celebrated Clay's, of Birmingham, japanned paper tea trays, &c. was a composition of wheaten flour and carpenter's glue boiled together. Each sheet of paper was united singly to the others by this paste, the air being carefully driven out from between them by wiping with a coarse cloth from the centre towards the sides; and they were carefully dried in stoves, after the putting on of each layer. Thus combined, they might be sawn, planed, nailed, and glued together, in the manner of wood; but the articles were much lighter and stronger, when japanned, than if formed of wood.

[*Technological Repository.*

Additional Remarks on the Stowage of Ships. By Commander JOHN PEARSE, R. N.

My former remarks (see vol. iv. page 145,) were written with the intention of endeavouring to show that we have no regular system for stowing our ships, and that an alteration in the distribution of the weights is necessary. Subsequent to their publication, I have seen an authentic calculation of the weight and pressure, according to the ordinary distribution in a modern 74 gun ship. This has induced me to publish these additional remarks, by which I shall be enabled to prove that the alterations I proposed would materially contribute to remedy the inequality of the weight and pressure represented in the calculation alluded to; and which is referred to in the following observations of Dr. Young's, in his remarks on the employment of oblique riders. *Philos. Trans.* 1814.

“It is unnecessary to explain here the well known inequality of the distribution of the weight and pressure, which causes almost all ships to have a tendency to arch or hog, that is, to become convex upwards, in the direction of their length. It is possible that there may be cases in which a strain of a very different nature is produced; but in ships of war this tendency appears to be universal.

“It is, however, very different in degree in the different parts of a ship; and, of course, still more different according to the different modes of distribution of the ballast and stores, which may occur in different ships; but, in ordinary cases, it will probably be found nearly such as is represented in the calculations subjoined in the note,* deduced from data, which have been obligingly furnished by an acute and experienced member of the Navy Board.”

* “In a modern 74 gun ship, fitted for sea, the length being 176 feet, the breadth $47\frac{1}{2}$, the forces are thus distributed.

Aftermost	49 feet	Weight	699	Pressure	627	Difference	72 tons.
Next	20		297		405	—	108
	50		1216		1098		118
	20		290		409	—	119
	37		498		461		37
	<hr/>		<hr/>		<hr/>		<hr/>
	176		3000		3000		000

By the above calculation, it will appear that there is an excess of weight at both extremities, and that in the adjoining sections the pressure greatly preponderates. Consequently, these forces are opposed to each other, and in a direction very prejudicial to the ship; as it is not only the evil of weight preponderating at the extremities, the power of which will be increased by the action of the ship, but from the formation of the body at those parts they can afford but a feeble resistance to so great a force.

Perhaps the following figures will best explain where the weights and pressure now preponderate, what particular weights may be supposed to cause an excess, and such as may be most conveniently and advantageously transferred.

Fig. 1.

Excess of weight 72 tons.	20 feet.	Excess of weight 118 tons.	20 feet.	Excess of weight 37 tons.
49 feet.	108 tons Excess of pressure.	50 feet.	119 tons Excess of pressure.	37 feet.

Fig. 2.

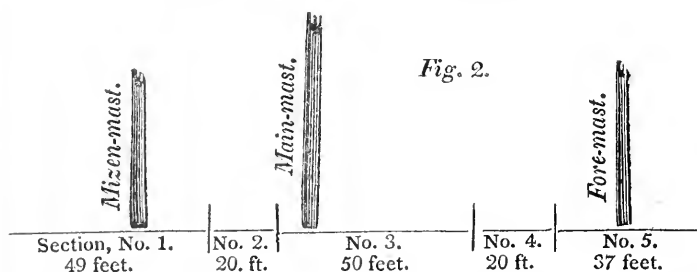


Figure the 1st represents the length of a 74 gun ship, divided into five sections, and the excess of weight or pressure in each.

Figure the 2nd also represents the length, divided into sections and the positions of the masts, by which it will be seen that they are situated in those parts where the weights preponderate; and that they greatly contribute to it is a very natural conclusion.

In the foremost section there is, unavoidably, not only the weight of the foremast and its rigging, but the bowsprit and anchors also; the latter stowed at the extremity of the section, and the bowsprit projecting considerably beyond it; which, on the lever principle, assisted by the action of the ship and the excess of weight, and being situated in a part which, from its formation, affords but little resistance, and which is frequently left unsupported, must considerably augment the pitching motion, and contribute to the tendency to arch or hog.

In the aftermost section, the mizen-mast may be considered as contributing to the excess of weight; but it is not of such magnitude as the fore or main-mast; and its position is much more favourable for the ship than the fore-mast. The strain also on the after part is not so great as forward, as it is seldom left so entirely unsupported

by the passing of a sea, and the sending motion is not so sudden or violent as the pitching.

In the extreme sections, and from the formation of those parts below the surface of the water, the upper works may also be considered as contributing to the excess of weight.

In the middle section, the main-mast, from its magnitude, may be considered as materially contributing to the excess of weight; and that, according to the ordinary distribution of the weights in the main hold, a large proportion of it may be supposed to fall in the vicinity of the mast. If this conclusion be admitted, it must appear prejudicial, and the more so, in consequence of the pressure preponderating so much at both extremities of the section. Among other weights concentrated about the mast is the shot locker, and which must considerably add to the unavoidable and too great weight of the mast alone acting on so small a space.

I shall now endeavour to explain how far the alterations proposed in my former remarks would be likely to remedy the inequality of the distribution of the weight and pressure specified in the calculation.

In the foremost section, No. 5, where there is at present an excess of weight, are placed the bower anchors, and the gunners', boatswains', and carpenters' sea stores, which I proposed transferring; the anchors further aft, by removing the cat heads to the fore parts of the channels, which, although by the removal still situated in the same section, would considerably lessen the power of their weight on the ship in a sea; and the sea stores to the after cock-pit, which will be found situated in section No. 2, where the pressure now preponderates.

In the after section, No. 1, where there is also an excess of weight, the bread is stowed at the extremity; a part of which, together with beds, slops, marine clothing, &c., (at present stowed in the after cock-pit) I proposed should occupy the present place of the sea stores in section No. 5; which would reduce the excess of weight at present in the after extremity, and place less weight, more lively, and more speedily consumed than the sea stores, in the place now occupied by them.

Such arrangements would also be likely to contribute to a more equal distribution of the weights and pressure in sections 3 and 4; as it would most probably admit of weight being removed from the one where there is at present an excess, to that where pressure preponderates,—and, in fact, to a much more equal distribution throughout the whole body.

The following alterations would also contribute to a better distribution than the present.

Let the bower and sheet cables be stowed further aft; the stream cable and hawsers abaft them, in the space now occupied by cabins, slop-room, &c.; and the stores, at present stowed in the foremost section, No. 5, removed aft to the fore part of the cable tiers; a part of the bread, slops, beds, marine clothing, &c., as in the former proposal, to occupy the present place of the sea stores in section No. 5. By such arrangements the weight of the stream cable and hawsers,

and part of the bower cables, would be removed to section No. 2; the sea stores to No. 4; and the weights reduced at both extremities.

The excess of weight would not only be considerably reduced in the fore extremity, by the proposed alterations, but at sea, if desirable to lighten this part as speedily as possible, a regular decrease, in a 74 gun ship, of two tons per week, may be calculated on, till the expiration of half the cruise, when the fore bread room would be cleared.

By a minute inspection and measurement of the different parts, and a correct calculation of the different weights and their bulk, the distribution may be made with great exactness.

Removing the anchors where they will stow perfectly clear of the ports, and similar to the sheet and spare anchors, will also leave the round of the bow perfectly clear, and remove every impediment to its being better fortified.

[*Quarterly Journal.*]

Experiments and Observations on some of the Phænomena attending the sudden expansion of compressed elastic Fluids. By PETER EWART, Esq.*

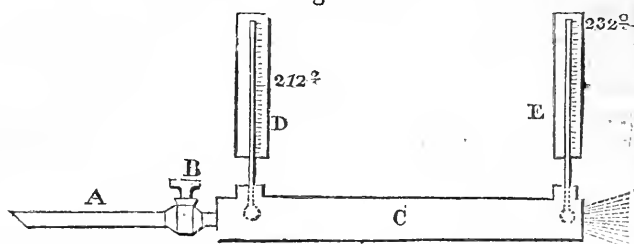
HAVING occasion, about seven years ago, to make some experiments on a high pressure steam engine of the estimated power of nine horses, in the boiler of which the elasticity of the steam was equal to sixty pounds (including the atmosphere) on the square inch, and, consequently, the interior temperature about 290° of Fahrenheit, I applied the bulb of a thermometer close to the opening of the safety-valve, while the steam issued from it in great quantity, and it stood steadily at 160° . The engine being in motion, and the steam, after having passed through the cylinder, escaping to the atmosphere by a perpendicular pipe four inches in diameter, and five feet in height, I applied a thermometer to the steam as it issued from the top of that pipe, and found the temperature to be 212° .

Finding the temperature of the issuing steam only 160° at the safety valve, close to the boiler, and 212° after it had passed to the distance of five feet from the boiler, I constructed an apparatus (fig. 1.) for the purpose of ascertaining whether, under certain circumstances, the temperature of the steam increases after it has issued from the boiler. I had an opportunity (in March 1823) of applying this apparatus to the high pressure steam boiler of Mr. Philip Taylor, at Bromley, near London. A is an iron pipe of three quarters of an inch bore, connected with the boiler, and terminated by a stop-cock B, the area of the opening of which was the same as that of the pipe. The end of a copper tube C, two inches diameter, and sixteen inches long, was screwed to the cock B, so as to be steam tight. To this tube was adapted a thermometer D, so that the bulb stood directly opposite the centre of the opening of the cock B, and at the distance of an inch and a half from it. The opening in the side of the copper

* This article consists of extracts from two papers read before the Literary and Philosophical Society of Manchester;—communicated by the author.

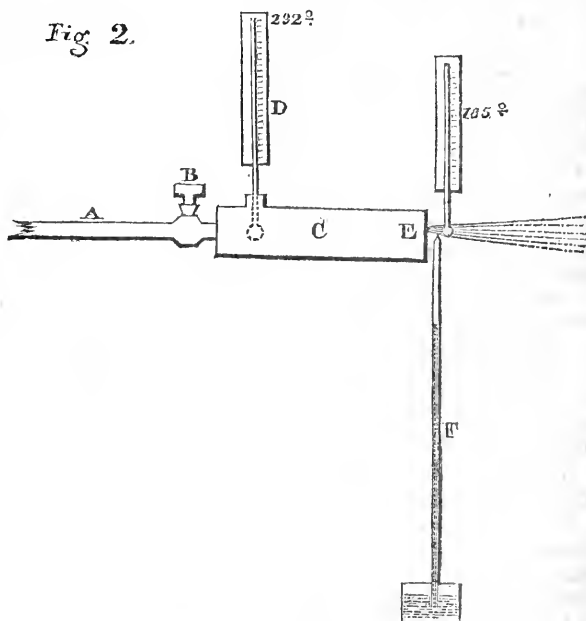
tube, through which the stem of the thermometer passed, was made steam tight. Another thermometer E was fixed in the same manner,

Fig. 1.



near the extreme end of the copper tube, which end was quite open to the atmosphere. The elasticity of the steam in the boiler being equal to fifty-eight pounds, including the atmosphere, on the square inch, (the internal temperature consequently about 285°) and the cock B fully open, the thermometer D stood at 212°; while E stood at 232°, showing an increase of 20° of temperature at that end of the copper pipe. The tube being removed, another copper tube C (fig. 2.) of the same diameter, and nine inches long, was screwed to the

Fig. 2.

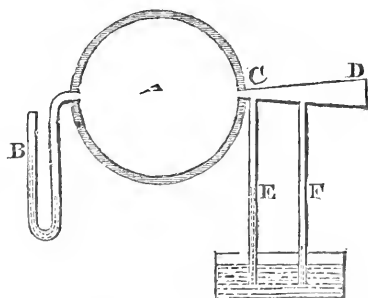


same cock B. This tube was furnished with a thermometer D as in the last experiment. The end E of the copper tube was stopped by a flat plate, excepting a hole $\frac{1}{2}$ th of an inch diameter, in the centre

of the plate. The steam in the boiler being about the same force as in the last experiment, and the cock B being opened, the thermometer D stood at 292° ; while another thermometer, having a very small bulb, held near the hole E, as the steam issued from it, stood at 185° . A small glass tube F, open at both ends and drawn to a fine point at the top, was placed so that the top of the tube was in the jet of steam issuing from E, while the lower end of it was immersed in a trough of mercury. The thermometer D standing at 292° , as before, the mercury rose twelve inches in the tube F. The mercury stood highest in F when it was near to E.

In August 1825, I had an opportunity of making some experiments on the sudden expansion of atmospheric air at Messrs. Fairburn and Lillie's foundry in this town, of which the following was one. A (fig. 3.) represents a transverse section of a cylindrical horizontal pipe, seven inches in diameter, which conducts air from a blowing apparatus to a furnace. B is an inverted glass syphon inserted into the side of a pipe A. A round hole, $\frac{4}{10}$ ths of an inch diameter, was made in the opposite side of the pipe, to which was adapted a conical tube of tinned iron CD, 5.4 inches long, and whose internal diameter was .4 inch at C, and 1.05 inch at the extreme end D,

Fig. 3.



which was open to the atmosphere. To the lower side of this conical tube, two perpendicular glass tubes, E and F, were attached, their upper ends opening into CD, and their lower ends being immersed in a trough of mercury. The centre of the tube E was .5 inch from the inside of the pipe A, and the centre of F was 2.2 inches from the centre of E. Some mercury having been put into the inverted syphon, and the blowing apparatus being set to work, (the air passing through A at the velocity of forty-five feet per second,) the mercury stood at 1.8 inch higher in the outer than in the inner leg of the syphon; while the mercury in the trough rose 2.7 inches in the tube E, and only .4 inch in F; showing a greatly diminished pressure in the air at E, while its pressure was much increased in passing from E to F. On the internal pressure in A being increased, the mercury rose higher in nearly the same proportion in E and F.

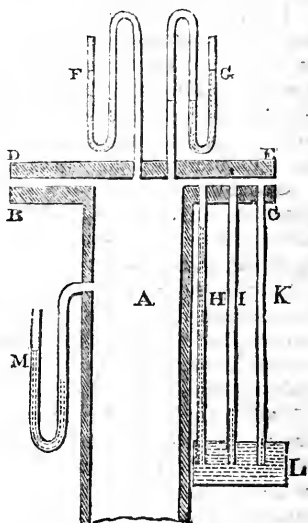
In the *Annales de Chimie et de Physique* for September 1827, there is an account of a fact observed in 1826 by Mr. Griffith, engineer, at Fourchambaut, which is described as consisting of this:—That if air strongly compressed in a reservoir escape by an orifice in a plane surface, and if a plate or disk of metal be presented to the jet of air, that plate is attracted to, instead of being repelled from, the flat surface from which the air issues.*

* This fact had been previously observed in October 1824, by Mr. Roberts, a member of the Manchester Philosophical Society.

In the same article in the *Annales de Chimie*, there is an account of some experiments and their results on the issuing of compressed steam.

Some of these results agreeing, and some being at variance, with those exhibited in figs. 2 and 3, I constructed the following apparatus for the purpose of examining more distinctly the effects produced by the expansion of compressed air under similar circumstances. A (fig. 4.) is a longitudinal section of a perpendicular pipe of four inches internal diameter, connected with a reservoir of compressed atmospheric air. BC is a cross section of a flat circular piece of wood 11.8 inches in diameter, having a circular orifice four inches diameter through its centre, and adapted to the upper end of A, so that this orifice shall coincide with the interior circumference of A. DE is the section of another flat circular piece of wood, of the same diameter as BC, and placed directly over it, and fixed so that it may be uniformly depressed or raised from BC by means of screws.

Fig. 4.



F is an inverted glass syphon inserted into the centre of DE, and G is a similar syphon inserted into DE, at the distance of 1.5 inch from F. H, I, and K are three small glass tubes, open at both ends, inserted into BC, and having their lower ends immersed in a trough L of coloured water. M an inverted syphon inserted into A. The centre of the tube H was at the distance of .9 inch; that of I, 2.1; and that of K, 3.4 inches from the interior side of A. The space between BC and DE being adjusted to .21 of an inch, some mercury being put into all the inverted syphons, and the compressing apparatus being set to work,—the syphons G and M indicated each an interior pressure of 1.25 inch, and the syphon F, 1.3 inch of mercury. The coloured water rose 9. inches in H, 2. inches in I, and .5 inch in K. On the interior pressure in A being increased, the coloured water rose higher, in nearly the same proportion, in H, I, and K; and the amount of the downward pressure on DE still much exceeded that of the upward pressure from A.

Some of these results being still at variance with some of those described in the article of the *Annales de Chimie*, already quoted, I prevailed on Mr. Dalton to witness a repetition of the experiments (fig. 4.) in November 1828, and he was satisfied that the results were correctly stated.

Various explanations have been proposed of some of the phenomena which I have described.

It has been supposed that the ascent of the mercury in figs. 2 and 3, and of the coloured water in fig. 4, is occasioned, not by the rarefaction of the fluid in contact with the upper ends of these tubes, but by the particles of fluid in the tubes (whether these particles be of air, water, or mercury) being drawn or sucked out by some kind of lateral action of the issuing fluid. But if there were any action of that kind, its effects would be apparent in the inverted syphon (fig. 3.); and the mercury in the leg next to Λ (in which the air was moving at the rate of forty-five feet per second) would have been elevated instead of being depressed.

I applied an inverted syphon to the air reservoir of a similar blowing apparatus, in which the interior pressure was equal to 33.5 inches of mercury (including the atmosphere,) while another syphon was applied to the conducting pipe, as in fig. 3, at the distance of twelve feet from the reservoir. The air was passing along the pipe with the velocity of forty-eight feet per second, and the interior pressure was only 1.268th part less in the conducting pipe than in the reservoir.

Explanations of the low temperature of high pressure steam, at the place where it issues, have indeed been proposed, without any reference to the rarefaction of the steam at that place. It has been held by some, that the steam issues with so great a velocity at that place, that it has not time to give out its heat; that unless part of the steam be condensed into water, little or none of its heat can be given out; and it has been asserted that when the hand is presented to such steam, it remains dry. Others have held, that the current of steam carries with it a current of air, attracted in some manner to its sides, by which the bulb of the thermometer is cooled.—My hand, however, has always been wet by the steam when presented to it; and in most of the experiments which I have made, the bulb of the thermometer was surrounded with steam; so that it could not be affected by any external air supposed to adhere to the sides of the current of steam.

That the temperature of high pressure steam, on being released, should come down to the temperature of steam of atmospheric pressure, is what might be expected. But how it instantly falls so much below 212° requires some explanation.

There are three circumstances to be observed in the foregoing experiments, which appear to require particular attention.

1st, The reduced pressure takes place in the greatest degree near the point where the air or the steam is released from compression. (See figs. 2, 3, and 4.)

2ndly, After the air has been suddenly expanded, it quickly recovers a large portion of its former density. (See figs. 3 and 4.)

3dly, A portion of elastic fluid of given density is displaced by another portion of the same fluid, of much less density than that of the fluid which has been displaced. (See figs. 3 and 4.)

In October 1822 I read a paper before this Society, giving an account of some experiments which I had then made on this subject, and suggesting an explanation of the results on mechanical principles. I did not offer it then nor do I offer it now, with the expectation that it will be generally considered as satisfactory. All the experiments, however, which I have made since that time, admit, as it appears to

me, of that explanation: and I have had the satisfaction to find that it has been adopted by several very good experimenters.

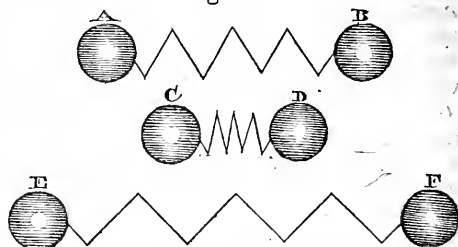
Such as it is, I beg leave to offer it again after an interval of six years, to the consideration of this Society.

If we suppose A and B (fig. 5.) to be two equal balls of lead attached to the opposite

Fig. 5.

ends of an elastic spring; and if we suppose the spring, in the position of A and B, to be in a neutral state, that is, to have no tendency either to expand or collapse.

If we next suppose the balls to be compressed together as at C and D,



and then suddenly set at liberty, they will, by the joint action of elasticity and momentum, spring out, not only to the distance they were at originally as at A and B, but to a distance as at E and F, as much beyond their original distance as they had been compressed within it. After having been separated to that distance, they will collapse and vibrate to and fro for a time.

Now if elastic fluids such as air and steam, consist of separate particles, we know that these particles are kept asunder by an elastic force, the same in effect as if steel springs were interposed between them; and we cannot doubt that such particles have momentum like all other ponderable matter; neither can I see any reason to doubt that the sudden expansion and contradiction of their distances must be similar to those of the leaden balls.

Thus, if we suppose A and B to be two particles of atmospheric air, at the distance they are in the atmosphere; if they be compressed as at C and D, and suddenly released, they will be separated as at E and F, and produce all the effects of a corresponding rarefaction or dilatation. It is true they may not separate so far as at E and F, because of the interruption they meet with from other particles of air in the atmosphere; but it is reasonable to conclude that they will separate beyond the distance of A and B. After being separated to their greatest distance, they will collapse, not by the reaction of the elastic force between them, as in the case of the leaden balls, but the similar action of the elastic force of the particles of air into which they are projected.

In this view of the phænomena, by the combined mechanical action of elasticity and momentum, the low pressure of highly compressed steam, at the place where it is released, becomes only what is due to its mechanical dilatation,—the consequence of its previous compression. And, accordingly, it is found that the more it is compressed, the more dilated and the colder it is when suddenly released.

[*Philosophical Magazine.*

On Substituting Plates of Fusible Metal, for Wood-Blocks, in Calico Printing, &c. By M. G. ENGELMANN.*

THE engraving of wood blocks for calico printing is very expensive, and these blocks being also formed of an hygrometric substance, are continually subject to change, from swelling and shrinking by the effects of moisture and dryness, and thus occasion a considerable loss of time, and give false impressions, from the trouble of replacing them, and the consequent inequality in their adjustments. I have therefore endeavoured to substitute for them, a substance which is not liable to swell by the action of humidity, can be moulded with great accuracy, and at the same time is capable of resisting the effects of the blows of the mallet, and of the acids contained in certain of the colours used in calico printing. The fusible alloy appears to me to offer these advantages, and I employ the *en cliché* process, in its application.

I operate in the following manner;—having made an engraving in wood, on a piece of plank, and given a sufficient breadth to the bottom of the lines, to enable the cast to part from the mould, I interpose between the metal and the wood a substance, which shall facilitate their separation; to effect this I brush over the engraving a mixture of ground *sanguine* (red-chalk,) and water. I then finally affix the engraved block to the bottom of the upright slide or stem of the stamp, and let it fall suddenly upon the melted fusible alloy, at the moment when it is just upon the point of becoming solid, or has acquired a *pasty* consistence; I thus obtain a counter proof of the engraving. This counter proof serves as the matrix or mould for the engraved plates of fusible metal which I intend to make. For this purpose, I affix it upon a piece of wood, and surround it with a border of metal, intended to determine the thickness of the metal plates struck in it; and which border is also formed in such a manner, as that whether placed on one side or the other, it shall exactly fit; I then firmly affix this matrix, thus surrounded with its frame, upon the bottom of the stem of the stamp, and strike another counter proof *en cliché*; and so proceed, until I have thus produced enough of them to compose and to cover a calico printing block.

These second counter proofs, thus obtained, I place, with their engraved faces undermost, the one by the side of the other, upon a flat surface; and also shape and dispose them with the necessary regularity, to ensure precision in the impressions from them. I then pass a heated iron along the joints, in order to solder one piece to another; and then fix the whole upon a wooden plank, by means of copper nails; but I previously varnish the plank, to prevent moisture from penetrating it. These blocks, if I may judge from the two experiments which I have made with them, offer no other inconvenience than being a little heavier than those made entirely with wood:

* From *Bullet. de la Soc. Indust. de Muhlhausen*; and Ferussac's *Bulletin des Sciences Technologiques*.

they differ however but little from those blocks in which the raised parts are made with brass or copper; a difference, trifling, in comparison with the great advantages they possess, in not being liable to change from the action of moisture.

It is easy to see, that a calico printing block, thus constructed, must cost much less than one engraved upon wood; and especially, as we need only to engrave a segment, or one of the parts, which are usually repeated a great number of times; and to multiply them by the *clichage*, an operation which will produce in less than an hour, more casts than are sufficient to fill a block, thickly covered with them. The value of the metal employed, and which need not be more than a line in thickness, is a mere trifle; and, after the block has done its work, may be remelted. We can preserve the small matrices, which occupy but little room, and when we require to make another block, it can be done quickly. It is also equally easy, in changing a moulded pattern, to vary the position of these small casts; since we can either bring them near together, or remove them to a distance apart; place them in a line, or mingle one piece with another; and thus either form them into borders, or employ them in the interior parts of the prints.

If we compare the price of these blocks, with those whose raised parts are formed of brass or copper, it is greatly in their favour; and we have no doubt that in the hands of skilful persons, the art of forming them by means of *clichage*, will obtain as great perfection as those blocks possess.

On Improvements in the Manufacture of Horn and Tortoise shell Combs. By THOMAS GILL, Esq.

THE author has long known, that *two large toothed* tortoise shell combs could be made out of one piece of tortoise shell; the interstices in the one, furnishing the material to form the teeth in the other, and *vice versa*; but he had no idea of the possibility of cutting two combs with fine teeth out of one piece; this is, however, now effected in the following manner:—The thin plate of tortoise shell being softened by heat, a fine and properly shaped chisel is passed through it, in such a manner, as to divide it into the teeth, and the spaces between them, but without removing or cutting away any of the substance of the tortoise shell; and thus the two combs can be formed, with great economy, out of this very expensive material.

Another great saving, in the same costly material, has likewise been effected by a German comb maker, settled in this country; who forms the solid broad part of the large toothed combs, now so generally worn by the ladies, out of tortoise shell; but their teeth are made in a plate of horn, *soldered* by means of heat to the tortoise shell; and that in so dexterous a manner, that although the place of the joining was pointed out to the editor, yet he was unable to distinguish any difference there, between that and the other parts of the comb. The veined or clouded appearance of tortoise shell was given

to the horn, in the usual manner, by means of oxide of lead and quicklime, or orpiment; and so ably was this managed, that it greatly contributed to prevent the juncture of the horn and tortoise shell from being perceived.

Our English comb makers also tinge or dye their horn combs in the above manner; but they very soon assume a dull appearance, owing to the lead in the dye becoming revived, and putting on its metallic appearance. Now the dyed combs, made by the German, have a most beautiful polish, which continues for a length of time unimpaired; so that it would seem that they had been coated or defended by a varnish. It is by no means improbable, that the French, or rather German polish, or varnish, composed of shell lac spirit varnish, applied by the aid of oil, has been used to defend the combs, and give them the beautiful polish above mentioned.

[*Tech. Rep.*

Remarks by the Editor.—The machines for cutting tortoise shell combs without waste of material have been made and used for several years in the United States. We believe that they were invented in Germany, but they have been much improved here. They are equally applicable to combs of all sizes. They not only save material, but time, and make better work. Our workmen solder the teeth into tortoise shell combs, perfectly, but we believe they have not combined the shell with horn. The beautiful polish of which Mr. Gill speaks is given upon the substance of the material, without the aid of varnish.

On Church Bells; their substance, weight, and form; mode of fixing and striking, &c. &c.

FOURTEEN centuries have now elapsed since the invention of bells, but it is not, comparatively, till of late years, that the attention of scientific men has been directed to the investigation of their proper form and composition.

The object which the ancients evidently had in view, was to collect the greatest possible mass of metal into their bells—the heaviest being most esteemed. The extent to which their labours were carried may be illustrated by the following list of a few of the largest bells, commencing with

	lbs.
That at Moscow, cast by order of Anne, empress of Russia, which weighed	432,000
Seven bells at Pekin, China, each of which, according to Father le Compte, weighed	120,000
St. Peter's (re-cast in 1785)	18,667
The Mighty Tom of Oxford	17,000
The Great Tom of Exeter	12,500
The do. do. of Lincoln	9,874
The Tom Growler (St. Paul's) London	9,520

Besides which, there are several others of immense weight, both in this and foreign countries.

The miraculous powers ascribed to bells, in the dark ages of monkish superstition, have been long since exploded. Perhaps the most ridiculous of all the extravagant practices of those times was "the Passion Bell," so called from being appropriated to the service of passion week. "To give this bell a tone appropriate to the sombre character of the season, it has been cast with several large holes round the top—a contrivance which, without diminishing the vibration of the metal, prevents the distinct formation of any musical note, and converts the sound into a dismal clangour."* During the continuance of practices like this, little improvement could be expected in the construction of bells.

Bell-founders of the present day have, however, begun to perceive the immense waste of metal hitherto incurred, and are convinced that a better sound may be obtained with, at most, one-half the weight of metal formerly used.

This appears to be the opinion of your talented correspondent, Mr. Harrison, who, in his interesting communication, says, "my researches have not only been directed to those proportions which will afford the greatest and most flowing sounds and deepest notes with a minimum weight of metal, but they have also been directed to effect a perfect concurrence of all the parts, so that the sweetest tones may at the same time be produced. Moreover, these proportions have also the effect of improving the shape considerably, it being allowed to have a very symmetrical and handsome appearance, so that it perhaps may not improperly be styled the perfection of the bell form." This is a somewhat fanciful idea, and will not apply to some improved bells that I have seen, which possessed the most rich and mellow tones, but certainly none of "*the perfection of the bell form.*"

With the greatest respect for the abilities of Mr. Harrison, and our other enlightened bell-founders of the present day, permit me to observe, that notwithstanding the great antiquity of bell-founding, I am of opinion that the art, in regard to improvement, is yet in its very infancy; and that no investigations hitherto made have furnished data sufficient to *establish* the form best calculated to give a maximum effect with a minimum weight of metal, in the construction of large bells.

Let any one, for a moment, consider the vast difference in form which exists between musical clock bells and those of a larger description. A comparison, of effect, in proportion to the weight of metal, is very much in favour of the former, but I have some notion that *perfection* lies in a form somewhere between the two. M. Reaumur, in a paper in the "Memoirs of the Paris Academy," on the shape most proper for bells to give them the loudest and clearest sound, observes, that "lead, a metal which in its common state is not at all sonorous, becomes greatly so on its being cast into a particular form, and that very different from the common shape of bells."

* Hone's "Every Day Book," vol. ii. p. 392.

This form, M. Reaumur afterwards observes, is the segment of a sphere, which shape is now given to the best musical bells, varying, however, in being more or less oblate; and he continues, "now, if this shape alone can give sound to a metal which in other forms is perfectly mute, how much more must it necessarily give it to other metals naturally sonorous in whatever form." M. Reaumur very judiciously observes, that had our forefathers possessed opportunities of being acquainted with the sound of metals in this shape, we should probably have had all our bells at present of this form. Mr. Drury, whose inimitable musical bells are so well known, has of late extended his researches to bells of a larger description, some of which he has cast and fixed; and he goes so far as to say, that he will produce a bell of any required note with ONE-FOURTH of the metal formerly used, and at the same time obtain a far more harmonious tone.

Another practice, which to me appears highly absurd, is the present mode of bell-ringing—where the whole mass of metal in the bell is put into motion to obtain that sound, which may be better elicited by moving the clapper only: for I am thoroughly convinced that a much finer tone may be drawn from every bell well struck by a hammer, than by any swing that can be given to a clapper in the interior of the bell.

We frequently read of bells that require *twenty-four* and *thirty-two* men each to ring them—whereas, one man with a suitable hammer, might have produced an equal, or even a superior sound. The bell at St. Paul's Cathedral is by some said to weigh 11,474 lbs. and its clapper 180 lbs. To make this large mass revolve, as it were, round the smaller, is as though the earth were to revolve round the moon, or the sun round the planets—while the reverse is well known to occur in the harmonious arrangements of nature. In addition to the immense waste of human labour, which takes place in our present mode of bell-ringing, there is another objection to this practice, from the liability to accident, and from the injury done to steeples, the stability of which, sooner or later, becomes destroyed.* Where the soundness of any steeple is questionable, it is necessary to put an immediate stop to the practice; and though not generally known, it is nevertheless a fact, that nearly one-half of the peals of bells in this country cannot, at the present time, be rung with safety. This is the case at Bow Church, the weight of whose bells is as follows:

								cwt.	qrs.	lbs.
First,	-	-	-	-	-	-	-	8	3	7
Second,	-	-	-	-	-	-	-	9	2	0

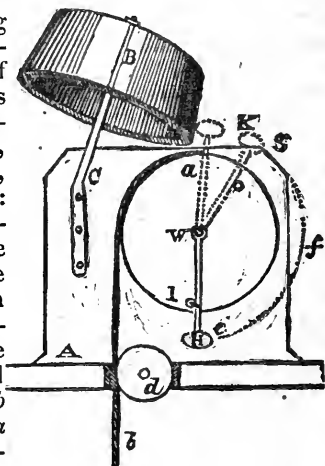
* On Monday afternoon, Nov. 9th last, while the grand peal of ten bells in the tower of St. Sepulchre's Church, Snow-hill, were ringing a merry peal (Whittington's) as the lord mayor's procession was passing, the tenor, or great bell, weighing 3300 lbs. broke asunder at the crown, and fell with a most tremendous crash into the pit beneath, to the great alarm of the ringers, who were three floors under, and were shook as if by an earthquake. They were, however, saved from destruction, by the strong oaken timbers of the floor, which received the bell, and arrested its farther progress.

								cwt.	qrs.	lbs.
Third,	-	-	-	-	-	-	-	10	1	4
Fourth,	-	-	-	-	-	-	-	12	0	7
Fifth,	-	-	-	-	-	-	-	12	0	24
Sixth,	-	-	-	-	-	-	-	17	0	11
Seventh,	-	-	-	-	-	-	-	20	2	26
Eighth,	-	-	-	-	-	-	-	24	2	25
Ninth,	-	-	-	-	-	-	-	34	2	6
Tenth,	-	-	-	-	-	-	-	53	0	2

In all about 10 tons, which swinging to and fro in such a place as the upper part of a high steeple, is sufficient to shake even those of the firmest construction. I should estimate the clappers of all the above to weigh about 400 lbs., which is all that need be put in motion to obtain the full effect from the bells.

When it becomes unsafe to *ring* the bells, they are what is technically called "clappered:" in this case the clapper only is put in motion, but under such unfavourable circumstances, that no wonder the sound thus produced is inferior to that obtained by ringing.

The sketch given exhibits an improved mode of fixing and striking bells, invented by Mr. Drury.— Upon a stand or upright piece of strong timber, A, the bell, B, is supported by an iron arm, C, incapable of motion: upon an axle, securely fastened to the stand, A, revolves a small grooved wheel, W: upon the same axle, also, freely revolves a rod or lever carrying the hammer, H. At *a*, one point of the wheel is attached the rope *a, b*: on the face of the wheel there is a projecting stud, I, against which the clapper arm rests. When the bell is required to be rung the rope *b* is pulled, which brings the point *a* of the wheel into the lowest position, and at the same time raises the hammer into the position K, by means of the stud I, upon which it rests; describing the arc *e, f, g*.



In passing over this distance, however, the hammer will have acquired such a momentum, that it will not stop with the wheel, but, leaving it, will strike the bell with such force, as to draw forth its full tone with the finest effect. The blow having been struck, the hammer falls back, partly from reaction and partly from its own gravity, upon the stud, I, and carries the wheel round into its original position, when another blow may be struck, and so on, *ad infinitum*. The parallelism of the rope is maintained by a small grooved wheel, *d*.

With this mode of fixing and striking, the full tone of the bell is obtained with the greatest ease, and with unexampled rapidity. M. Perrault considers bells as composed of an infinite number of rings, which, according to their different dimensions, have different tones, as chords of different lengths have; and, when struck, the vibrations of the parts immediately struck determine the tone; being supported by a sufficient number of consonant tones in the other parts. I should therefore suppose the fewer the number of these rings—and the smaller their difference in length, and consequently in tone, the more uniform and harmonious will be the sound produced. The form of bell adopted by Mr. Drury, as sketched above, coincides in every respect with this position: the high notes produced by the smaller rings of bells of the usual form, which are antagonizing ones, are in the new form wholly got rid of; and this may, in some measure, account for the depth of tone which these bells possess.

Before dismissing this subject, I may observe, that the just proportions of *weight* and *velocity* for the hammers of clock bells, furnish an interesting and ample field for speculative research. The existence of these proportions is by some denied: that they do exist, however, may be satisfactorily established, by considering the two extremes of the case. Thus, for instance, let us take the great bell at St. Paul's Cathedral; and, in the first instance, suppose that an iron musket ball, weighing one ounce, is fired direct against it: in this case we have a hammer of *small weight* moving with prodigious *velocity*. Secondly, let us suppose a weight of nine or ten tons moving very slowly, say through the space of two or three inches per second, or at such a rate that its numerical momentum shall be the same as that of the musket ball in the first instance: in this case we have *great weight* with a very small velocity; and it is pretty clear, that in neither case will any thing like the full tone of the bell be brought out: it remains therefore to ascertain that proportion, in which the weight and velocity of the hammer shall be such, as to produce the full effect of the bell. Inattention to this circumstance is, in many cases, the reason why such an imperfect sound is elicited from bells when struck by the clock hammer, and is an error into which the best workmen have sometimes fallen.

Europeans generally use iron, the Chinese, wood, for the construction of bell hammers. The iron is unquestionably the best of the two; but I am of opinion, that some substance, perhaps an alloy, may yet be discovered far more appropriate than either one or the other.

WM. BADDELEY, Jr.
[*Mechanics' Magazine.*]

Important Experiments on the Friction of the Wheels of Carriages.

A NUMBER of experiments were made lately on the Liverpool and Manchester Rail-way, under the directions of Mr. Hartley and Mr.

Rastrick, engineers, with a view of determining, 1st, what are the comparative merits of various patent wheels and axles for rail-way wagons; and, 2nd, what is the actual degree of friction of each; or, in other words, what proportion the force requisite to move or propel such wagons upon a rail-way bears to their load.

As the report of the engineers has not been yet made public, we cannot inform our readers which of the different patent wheels has been found to answer best, but we learn with great satisfaction that the following results have been deduced from the experiments:—

1. That a reduction of the proportion of the bearing of the axles of rail-way wagons to the circumference of the wheels, causes a proportionate reduction in the friction.

2. That with loaded wagons, the bearing part of the axles of which is only $1\frac{1}{2}$ inch diameter, the diameter of the wheels being 3 feet, or thereabouts, the friction is less than 6 lbs. to the ton, that is, only 1 in 400.

3. That though friction rollers at the axles of wagons are in some respects advantageous, the great modern improvement consists in reducing the diameter of the axles.

As the wagons used on this occasion were the same which were employed at the Rail-way Competition, in October last, it follows that the power of the competing engines was then underrated *one-half*, inasmuch as the friction at the time was computed at 12 lbs. to the ton, or rather less than 1 in 200. But the most important deduction we are disposed to draw from these experiments is, that steam carriages can never be expected to run successfully *except on rail-roads*. The resistance to the rubbing surface of the wheels on a rail-way is as nothing, and the friction only 1 in 400: and admitting the power of an engine to carry a load up an ascent of 1 in 30 to be only one-eighth part of its power on a level, still the force of the engine working on a rail-way must be ever pre-eminently superior to one working on our common roads, on the very best of which the resistance and friction together are as much as 1 in 20 in summer time, and 1 in 10, or 1 in 12, and never less than 1 in 15, during the winter half of the year. For heavy goods, at a slow rate of travelling, and on comparatively level roads, steam drags may be used as substitutes for wagons and vans; but the rapid pace now required by modern impatience can only be expected to be attained along rail-ways, which, to obviate danger, should be as completely isolated, by fencing and bridging, as canals now are. [16.]

On the manufacturing of Perfumed Imitative Wax Candles. Patented by M. LORRAINE, of Paris.

CANDLES made of tallow only, are unctuous, opaque, greasy, little sonorous, especially in summer, liable to run or gutter, and readily acquiring a rancid smell. These inconveniences are avoided, by putting fat, which has been melted and run into cakes, to ferment in a

stove where the heat is moderate: this fat distils, and throws off an oily liquor, which is removed with a piece of linen, or a sponge.

To free the grease from the fleshy and fibrous parts by which it is accompanied, it is first chopped, and after being washed in several waters, it is boiled with a given quantity of Roman alum. The alum soon separates, and destroys the heterogeneous parts, and we obtain a pure clear fat, which will last a very long time. The fat chopped and melted is run into buckets full of water distilled from aromatic simples, such as lavender, thyme, rosemary, &c. The fat and water are beaten together with a spatula, to effect a union. After forty-eight hours, the fat is separated from the water by means of a water bath. The water alone is disengaged, and the aromatic and odoriferous parts remain incorporated with the fat. To complete the purification, the fat is liquified and scummed, till no foreign substance nor water remains. This will be known by the limpid state of the fat, which then yields only a pure white scum. Still greater purity is obtained by a second quantity of alum incorporated with the tallow.

Before casting or running the candles, a composition is made, of half wax and half spermaceti, which serves to prepare the wicks. This composition, harder and more cohesive than the tallow, makes the candles less subject to gutter, makes them firmer, last longer, and require less snuffing. At the moment of removing the pure liquified tallow from the fire to cast the candles, a certain quantity of gum arabic dissolved in water, and united with a small quantity of wax and alum, is incorporated with it. The whole are beaten together, and when the tallow has settled well, and cooled to a certain temperature, it is poured into the moulds. By this preparation, in proportion as the cooling takes place, the foreign substances proceed to, and fix at the surface of the candles, forming a kind of covering, pleasant to the touch, like wax candles. This covering also prevents the candles from guttering, and enables a person to handle, and even rub them, without greasing the fingers, and without communicating any other smell than that of the aromatics entering into the composition.

The last operation for preventing the guttering of the candles when burning, and giving more solidity to them, is to prepare some gloves' size, very weak, and boiled with another quantity of gum and alum, and to pass a hair pencil, dipped in this size, all over the candles, and the next day after they may be used.

Candles prepared in this way are clear, transparent, sonorous, and last longer than others. They feel like bougies, and have the colour of pure wax.

[*Description des Brevets.*]

MODERN ANTIQUES, No. 2. *By the Editor.*

Description of a Truck on a new construction, invented by M. D'HERMAND, showing a method for diminishing friction in machines.

THE foregoing is the title of an article in vol. 3 of *Machines Approuvées par L'Academie Royale*, dated 1713. We have given a cut
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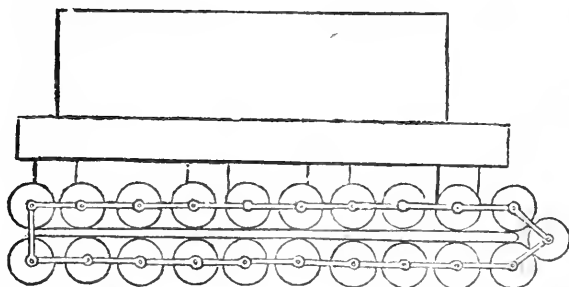
of the machine as described in the above work; there, however, the different parts are represented in detail, which we have omitted as not necessary to our purpose.

More than one modern Dedalus has reinvented this truck or car of M. D'Hermand, as the files and shelves of the patent office will prove; and various ingenious contrivances have been made, to change the rubbing friction of carriage wheels for the rolling friction. Garnet's friction rollers have been repeatedly applied for this purpose. Rollers are familiar as used under heavy boxes, and other weighty articles; these, however, soon run out behind the load, and have to be re-applied in front. M. D'Hermand speaking upon this subject, says, "In using rollers as they are ordinarily placed under a load to facilitate its removal, it is extremely difficult to keep the rollers parallel to each other, whatever care may be taken for this purpose. In order to remove this difficulty, the rollers are each furnished with pivots, or gudgeons, in their centres, and connected to each other by straps in the manner shown in the figure, by which means their parallelism is perfectly preserved."

"The carriage is composed of two frames on platforms parallel to each other, and united together by standards mortised into the edges of each. Upon the upper platform the load is to be placed, whilst the endless train of rollers have room to pass between this and the lower platform. The rollers turn easily upon their pivots, and as the load is drawn forward, they circulate freely round the lower platform."

"It is manifest that from the number of rollers which sustain the load, each one supports but a small portion of it. They add but little to the weight themselves, from the manner in which they act, and the roller which is passing up at one end has its weight counter-balanced by that which is descending at the opposite end."

"It is requisite that the ground upon which this truck, or car, is used should be perfectly level and very solid, in order that the rollers may act equally in every part," &c.



We are aware that some of our patentees will be sadly disappointed at finding themselves anticipated by this obtrusive Frenchman, who certainly had no good reason for inventing such a car be-

fore others had invented the rail-road. We have but one consoling opinion to offer upon this subject, and that is, we do not believe that the invention will be found to be of any practical utility, even upon rail-roads of any description; the joints are too numerous, and the whole structure would be too complex as applied to a carriage of any kind, excepting one of the diminutive size proper to be placed on a shelf in one of the cases of the patent office.

The cut is without letters of reference, as the description given will fully explain the intention of the different parts.

An account of an extraordinary adhesion of the Safety Valve of the boiler on board the Steam Boat Legislator, on the Hudson. By the ENGINEER.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

SIR,—The late awful explosion of the steam boat Helen M^cGregor, has brought to my recollection an accident that occurred last summer under my own eye. Believing it may serve the cause of humanity, I think it my duty to make public the fact: it is this.

Last summer I was engineer on board the steam boat Legislator, belonging to Hudson; standing on the forward deck, I noticed that the engine was working faster than common, and not seeing any steam flow as usual from the safety valve, I started for the fire room, where I met the fireman then on duty; he told me that he had on 21 inches of steam, and that the rod in the steam gauge was up against the boiler deck. As the safety valve was loaded to carry only 16 inches, I became alarmed, and went to the fire-room and took hold of a cord that ran over a pulley and was attached to the lever of the safety valve, and attempted to raise the valve, but could not; I was still more alarmed, and went on the top of the boiler, where the safety valve was, and found all right there, that is, there was no extra weight on the valve; I then slid the weight in to the length of the lever up to the fulcrum, where the weight was merely nominal; still the valve did not rise; I became confounded; I took hold of the lever and lifted on it pretty stoutly, and continued lifting for some seconds, when all of a sudden, with an explosion like that of the report of a small field piece, the valve opened, and the steam rushed out violently; it continued to do so for some length of time before the steam got down to the usual pressure, the engine being at work all the time. There was no water on the valve, nor any visible obstruction to its rising of its own accord after the steam got beyond the pressure of 16 inches, which it had invariably done before. Now, sir, must not this obstruction to the valve rising have been caused by an adhesion that took place between the valve and the valve seat, both of the same metal—I think it certainly must have been caused by this adhesion of the metal only. I have had an experience of 12 years as an engineer, and never knew the like occurrence before. For many reasons I have not placed full reliance in the mercurial steam

gauge, but have always had entire confidence in the correctness and safety of the safety valve; but in this case I was deceived, and perhaps in a few moments more an explosion might have taken place, for I have no doubt that if the small rod in the steam gauge had had a free passage through the boiler deck, it would have denoted 30 instead of 16 inches.

It is usual on board steam boats to have the steam gauge so graduated as to show as many inches of steam as the engine will take, and to have the safety valve loaded so as to agree with the steam gauge, believing that when the steam gauge indicated 16 inches of steam, all the surplus steam would escape through the safety valve; engineers, or many of them, are in the habit of not blowing off any steam when the boat stops to make a landing, but depend wholly on the safety valve rising of itself after the steam has risen a little above its required height. This has been considered a safe way of proceeding, but the case stated above shows, most conclusively, that it is wrong to depend too much on the safety valve. I would recommend, by all means, that when a boat stops to land passengers, that the safety valve be raised, let the gauge indicate what pressure it may; this, sir, is the only safe way. Might not the engineer of the *Helen M'Gregor* have placed an implicit confidence in his safety valve rising when the steam had got to its required height, and is it not possible that an adhesion had taken place between the valve and the seat? and perhaps at the same time he was waiting for the valve to rise, he had double the required quantity of steam, which caused the awful explosion; such may have been the fact. Before the occurrence of my safety valve not rising when it ought, I had believed the cause of boilers exploding was, almost invariably, the want of a sufficient quantity of water. I now think some explosions may be attributed to the being deceived by the safety valve not rising as was expected by the engineer. If you think the above stated facts are worth a place in your valuable *Journal*, you are at liberty to insert them. You will please to word and arrange this account to suit yourself. I know nothing about making out a statement for a public print, but you may rely on the correctness of the fact above narrated; it can be testified to by the pilot, the clerk, and the fireman of the boat.

Your obedient servant,

JOHN B. CALHOUN, *Engineer.*

New York, April 12, 1830.

Remarks by the Editor.—We insert the preceding communication in the form in which it was received, and shall always be much gratified by the correspondence of observing practical men upon subjects with which they are conversant. The simple, unpretending style in which the foregoing facts are narrated, could not be improved by any effort of ours.

We differ from Mr. Calhoun in his estimate of the value of the mercurial steam gauge, and think that the case stated must convince him of its utility. In order to judge of the cause of the adhesion, the

exact form of the valve, and other circumstances relating to it, ought to be known. So far as the account goes, it appears that there was, in the present case, an actual adhesion of the valve to its seat, which, although not unfrequent to a certain extent, existed with a degree of force which was extraordinary. Our scientific readers are acquainted with that kind of adhesion which was first brought into general notice by M. Clement, of France, and which has since given rise to much discussion; there is nothing, however, to lead to the conclusion that the present case was in any way related to it, as an emission of steam would then have accompanied the adhesion. Our wish is to excite discussion rather than to offer opinions; we shall, therefore, leave the question, at present, to our correspondents.

On the alloy of Zinc and Tin. By M. KOESCHLIN.

THIS alloy is nearly equal to brass in tenacity, and resists friction as well. It is cheaper, since the mean price of the metals composing it is only eighty per cent. the cast off brass, and the pieces may be used as delivered from the moulds.

It is essential that the zinc employed be very pure; for on the purity depends the tenacity and fusibility of its alloy, which, if made with impure zinc, would readily break, would wear away rapidly, and would not run well in casting. The following are the different alloys proposed by the author:—

1 part of tin	}	fusible from 260° to 300° ($=500^{\circ}$ to 572° F.)
3 parts of zinc		
2 do. tin	}	do. 300° to 350° ($=572^{\circ}$ to 662° F.)
4 do. zinc		
3 do. tin	}	do. 320° to 360° ($=608^{\circ}$ to 680° F.)
2 do. zinc		
Equal parts of tin and pure zinc.	}	do. 250° to 350° ($=482^{\circ}$ to 662° F.)
Ditto of tin and impure zinc.		
		do. 450° to 500° ($=842^{\circ}$ to 932° F.)

[*Buln. de la Soc. Industr. de Mulhausen.*]

Meteorological Influence of Terrestrial Electricity.

THIS subject has been treated of by M. Carlo Matteuci, of Bologna, who endeavours to found certain explanations of natural phenomena upon the supposed accumulation of electricity upon the surface of the earth. He considers that there is an accumulation of this power upon particular localities, the electricity itself being developed by evaporation, or other circumstances, upon the surface, or by internal

chemical action; and when developed, being retained in particular situations by the non-conducting power of the neighbouring earth. This non-conducting power is supposed to depend either upon the particular nature of the ground, or upon its becoming dry by evaporation, and, therefore, it is said, it is rather upon elevated and isolated places than upon plains, above rocks than over forests, in summer than in winter, and in the middle of the day than during the night, that those stormy clouds are formed which frequently can only be explained by terrestrial electricity.

One explication furnished by this theory, is considered as ingenious; it applies to those luminous appearances which so frequently occur in the atmosphere during the evenings and nights of summer, and are called heat-lightning. These are attributed to electricity produced and accumulated as already mentioned. After sunset, the vapours which condense, form a conducting stratum near the surface, which serves gradually to re-establish the electric equilibrium between the earth and the atmosphere. It is especially in plains, that these flashes are observed, because the electricity accumulated on high and isolated places escapes rapidly in consequence of their form, lower temperature, and the greater rarity of the atmosphere about them.

Sometimes these discharges are supposed to be very powerful; and when the earth and air are very dry, are thought capable of producing earthquakes such as occur after dry seasons; and a very ancient method of avoiding such earthquakes is quoted and approved of, namely, the introduction of long bars of iron into the ground to considerable depths. These, it is supposed, serve to conduct off the accumulated electricity. The *Bibliothèque Universelle* very properly remarks, that it is desirable that this accumulation of electricity upon the surface in the manner described, and upon which the whole hypothesis rests, should be proved in a decisive manner.

[*Bib. Univ.* xlii. 8.

Preservation of Blood.

SUGAR refiners and others are often inconvenienced by the difficulty of obtaining blood at the time when it is required for use. M. Toursel has endeavoured, in part, to remove this difficulty, by proposing a method of preserving this agent for some time without injury. It consists in putting the blood into bottles, or other vessels, with very narrow mouths, and being careful to fill them up to the neck; a layer of oil, to the depth of at least half an inch, is then put upon it to cut off communication with the atmosphere, and the whole is left to itself. M. Toursel states that he has, in this manner, preserved blood, with all its physical and chemical qualities, from the 1st of December, 1827, to January, 1829.

[*Journ. de Commerce.*

LIST OF ENGLISH PATENTS

Which have passed the Great Seal, from July 2nd, to September 23d, 1830.

To Elijah Galloway, for improvements in steam engines, and in machinery for propelling vessels, which improvements are applicable to other purposes—July 2nd.

To Jacob Perkins, for improvements in machinery for propelling steam vessels—July 2nd.

To Thomas Kilby, and Hugh Ford Bacon, for a new or improved gas lamp or burner—July 2nd.

To Robert Crabtree, for a machine or apparatus for propelling carriages, vessels, and locomotive bodies—July 4th.

To William North, for an improved method of constructing and forming ceilings and partitions for dwelling houses, warehouses, workshops, or other buildings, in order to render the same more secure against fire—July 4th.

To Margaret Knowles, for an improvement in axle-trees for, and mode of applying the same to carriages—July 4th.

To George King Sculthorpe, for improvements on axles or axle-trees, and coach and other springs—July 4th.

To Joseph Clisild Daniell, for improvements in machinery applicable to dressing woollen cloth—July 8th.

To William Leeson, for improvements or additions to harness and saddlery, part or parts of which improvements or additions, are applicable to other purposes—July 8th.

To Thomas Salmon, for an improved malt kiln—July 8th.

To William Ramsbottom, for improvements in power looms for weaving cloth—July 8th.

To Moses Poole, for improvements in the apparatus for raising or generating steam and currents of air, and for the application thereof to locomotive engines, and other purposes—July 8th.

To James Chesterham, for improvements on machines or apparatus for measuring land, and other purposes—July 14th.

To George Straker, for an improvement in ships' windlasses—July 25th.

To Louis Quetin, for a new or improved vehicle, for the carriage of passengers or goods—July 25th.

To Francis H. N. Drake, Esq. for improvements in tiles for houses and other buildings—July 25th.

To John Nicholls, for improvements in the lever, and the application of its power—July 25th.

To Joshua Bates, for an improved method of constructing steam boilers.—August 1st.

To Joshua Bates, for a new process of whitening sugars.—August 1st.

To John Hutchinson, for improvements in machinery for spinning cotton, &c.—July 30th.

To Nathaniel Jocelyn, of Newhaven, Connecticut, for improvements in the manufacture of blank forms for bankers' checks, &c. to prevent forgery—August 3d.

To Thomas Baily, for improvements in machinery for making lace.—August 5th.

To Thomas Brown, for an improved coach.—August 5th.

To William Shand, for improvements in distillation—Aug. 10th.

To John Mac Leod, for improvements in preparing barilla—August 10th.

To James Rowland, and Charles Mac Millan, for an improved process of constructing street ways, &c.—August 11th.

To Thomas H. Rolfe for improvements upon the self acting piano forte—August 11th.

To Edward Weeks, for improvements in raising fluids to various distances—August 14th.

To Henry C. Price, and Charles F. Price, for an improvement in apparatus for communicating heat—August 20th.

To John Mushet, for a certain medicine for gouty affections of the stomach, spasms, &c.—August 20th.

To John Jones, for improvements in machinery for dressing woolen cloths—August 21st.

To William Roger, for improvements in the construction of anchors—August 21st.

To G. H. Manton, for an improvement in the construction of locks for fire arms—September 2nd.

To J. Tucker, for certain improvements in the construction of cannon—September 9th.

To T. S. Brandreth, of Liverpool, for a new method or methods of applying animal power to machinery—September 9th.

To J. A. Fonzi, Esq. for certain improvements on, or additions to, fire places—September 9th.

To J. Soames, Jun. for a new preparation or manufacture of a certain material produced from a vegetable substance, and the application thereof to the purposes of supplying light—September 9th.

To T. Morgan, for a new method of manufacturing or preparing iron plate—September 9th.

To R. Torrens, for certain apparatus for the purpose of communicating power and motion—September 9th.

To D. Lawrence, for certain improvements in apparatus to be applied to fowling pieces and other fire arms—September 15th.

To G. Harris, R. N. for improvements in the manufacture of ropes, cordage, canvass, &c.—September 15th.

To John Milne, for a machine or engine for dressing of stones—September 15th.

To James Atchison, for certain improvements in the concentrating and evaporating of cane juice, &c.—September 15th.

To Thomas Cobb, Esq. for certain improvements in the manufacture of paper for the hanging of rooms, &c.—September 15th.

To T. Westwood, for certain improvements in watches and time keepers, September 23d.

JOURNAL
OF THE
FRANKLIN INSTITUTE
OF THE
State of Pennsylvania;
DEVOTED TO THE
MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,
AND THE RECORDING OF
AMERICAN AND OTHER PATENTED INVENTIONS.

—
JUNE, 1830.
—

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN MARCH, 1830.

With Remarks and Exemplifications, by the Editor.

1. For a machine for *Sawing Barrel, Keg, and Hogshead Staves*; Daniel Toms, Auburn, Cayuga county, New York, March 2.

The saws used are bent flatways, so as to be semicircular, or in the form of a half hoop, their curvature being adapted to that of the stave they are intended to saw. A strong frame is made to support the shaft of the saws, the carriages, timber, &c. An iron shaft to which the saws are attached extends along this frame; and two semicircular saws being joined together at their ends, form a hoop surrounding this shaft; they are held in their places by two arms which extend out at right angles from the shaft; and stand upon it, therefore, like a wheel with two arms and a flat rim. The carriage and shaft may be made of sufficient length to work two such circular rims, or four saws, which may be of different sizes; these saws have teeth upon each of their edges. A vibrating motion is given to the shaft, by means of an iron arm attached to a crank. The head blocks which support the timber are of cast iron, and there is, of course, a proper feeding gear to move the carriages. If there are two circular rims as above described, four staves may be sawed at once, one by each saw. The carriage is not drawn back when the stave has been sawed off, but the timber is shifted, so as to be cut on its return by the other edge of the saw. It is observed, that by this apparatus,

limbs, and other rough timber, may be readily formed into staves, and that with a small water wheel the machine will saw four staves in a minute, to the exact curvature required.

There is no claim, a defect which, in most cases, would be fatal to a patent; but, in the present instance, as the machine appears to be essentially new in its general structure, by a liberal construction of the specification, the particular subject of the patent might be deemed to be sufficiently defined; this, however, ought never to be depended upon. Of the goodness of the machine we have little doubt, and do not know of any one with which it interferes.

2. For an improvement in *Carriages for Rail-roads*; William P. Orrick, Reading, Bucks county, Pennsylvania, March 2.

More new, old fashioned, friction wheels. "The four large flanch wheels are made of cast iron in the usual way; each pair having an axle; these axles are turned true for the wheels to turn on, and have each two journals, also turned true, and two shoulders to each journal for the reception of the friction wheels."

"There are four friction wheels to each axle of the large wheels, and so situated on their gudgeons as to be nearly in contact with each other, and rest upon and revolve with the large axles before described."

These are in fact friction wheels of the most common kind, without an attempt at novelty. In framing the body of the carriage, the lower timbers are left so as to project out, just as they do behind a common cart, "to prevent the upper part of the bodies of the carriage striking and injuring each other when coming in contact."

"What I claim as my particular invention, is, the use of the friction wheels as above described and applied, resting on the larger axles, and turning in journals, and secured by the shoulders, whereby the main axles turn with the friction wheels at the same time the wheels turn on their axles. I also claim the use of the projection at the ends of the carriages as above described for preventing any injury from the carriages striking each other." Should such projections be left for the purpose of strength behind the mortise, as has often been done, this we presume would not interfere with the claim of the patentee, although they might even then, accidentally, keep the bodies of the carriages from contact with each other.

3. For an improvement in the *Construction of Clocks*; James Bogardus, New York, March 2.

(See specification.)

4. For a machine for *Reducing various articles, such as Apples for Cider, Dying Woods, Bark for Tanning, Corn with the Cob, &c. by cutting, to a degree of fineness suitable to the several operations*; David Parmelee, Reading, Fairfield county, Connecticut, March 4.

The machine for the above purpose consists of a wooden cylinder

made in radiating segments in such a manner that the end of the grain may form its whole surface—steel plates pass from end to end of this cylinder, at about three inches apart, the plates are bevelled something like a plane iron, and notched square down, so as to leave teeth with cutting edges of about one-eighth of an inch in width, and about the same distance apart. The plates are fixed in grooves, and by means of a key at one end, and a screw and nut at the other, they can be tightened, removed, and replaced. It is proposed to notch them at both edges, that they may be turned when required.

This cylinder is to be made to revolve rapidly within a trough, the cutting edges being nearly in contact with its sides; a hopper is to be placed above to feed the cutters. There is no claim.

We fancy that a stone, or other hard substance, mixed with the apples, &c. would make bad work with the cutters.

5. For an improvement in the construction of *Iron Wheels for Rail-road Carriages*; John Finlay, Baltimore, Maryland, March 4.

(See specification.)

6. For a machine for *Breaking and Dressing of Hemp and Flax*; Roger Halladay, Thomas Eldridge, Clemons Gibbs, and James B. Smith, Hartford, Washington county, New York, March 4.

The present patent purports to be for an improvement upon a machine for the same purpose, patented by Asa Hook, September 9th, 1823. The whole machine bears a strong resemblance to several others already in use. It consists of a large cylinder, between which and some smaller cylinders the material to be broken and dressed is to pass; besides these small cylinders there is also a piece of timber of the whole length of the large cylinder, forming a segment of $\frac{1}{16}$ of a circle, between which and the cylinder the flax or hemp is operated upon. The explanation is deficient in clearness, and the drawing is very indifferently executed. The claim, which is as follows, is, we think, in terms much too general and indefinite.

“The improvements we claim are as follows; by enlarging and adding to the frame; by attaching the beaters on a cylinder and dressing at each end; by using a sixteenth part of a circle, and combining together the small fluted cylinder, and the sixteenth part of a circle to form what was called in the flax machine a quarter circle. And finally, we claim as inventing and combining together all that is here specified, or noticed in the draft, which was not patented to Asa Hook, on the 9th of September, 1823, which is the original patent of which we wish for the patent for the improvements on.”

7. For a *Machine for Making Brick Mortar*; Amos Parker, Sweden, Oxford county, Maine, March 5.

This machine is similar to, at least, one other which has been pa-

tented. It consists of a wheel running in a circular trough, within which the clay is put. From a vertical shaft in the centre of this trough, a horizontal shaft projects out, which is to be drawn round by a horse; on the body of this shaft a screw is cut, which passes through the centre of the roller, or wheel, which is to grind, or mix the clay. When the horse passes one way, the wheel recedes from the outer part towards the centre of the trough, and on turning the horse, it returns back again.

There is no claim whatever, and the description is, in great part, taken up with minute measurements, not one of which is essential, or important. What is given as a drawing does not deserve the name, being a mere scratch, those parts which are vertical, and those which are horizontal, are all laid down on the same plane.

8. For a *Churning Machine*; Henry Schively and Robert M'Euen, Frederickburg, Wayne county, Ohio, March 6.

A shaft, with dashers standing at different angles, is turned round by means of a crank, attached to a multiplying wheel. There is certainly little to claim in it, and nothing is claimed; something called a drawing accompanies the specification, but it is without written references.

9. For a *Wooden, or Framed Bridge*; S. H. Long, Baltimore, Maryland, March 6.

(See specification, page 231.)

10. For a *Folding, Pocket Tooth Brush*; Philos Blake, New Haven, Connecticut, March 8.

A very particular and clear description of this brush and case are given, which, however, we do not think it necessary minutely to follow. The part which forms the handle is united to that containing the bristles by means of a pivot, enabling them to fold upon each other. The lower part of the handle has attached to it a metal, or other case, into which the brush passes, there being a lid hinged in the manner of a snuff box lid, to shut it neatly up for the pocket. The patentee says:

"I do not claim to have originated the idea of making a tooth brush portable by enclosing it in a case, nor that of making the case serve the purpose of a handle when it is used, but I do claim the invention of connecting the brush to its case by a pivot, or revolving joint. I also claim as my invention the improvement or construction as herein described, of the several parts by which the brush and its case are respectively adapted to this mode of connecting them in a new form, firm in use, and more compact and convenient for the pocket than any other."

We should be very apprehensive that tooth brushes made as described by the patentee, must be sold at a price which would prevent their employment to any considerable extent. We have seen brushes

with a screw handle, and a small case, offering, we think, all the advantages proposed, and recommended by their greater simplicity; but even these we have rarely seen in use.

11. For an improvement in the *Construction of Steam Boilers, Stoves, Chimnies, &c.*; John James Giraud, M. D., Baltimore, Maryland, March 8.

If the apparatus described accomplishes a moiety of what is claimed for it, its value will be very great. It is, "1st, to produce as great a quantity of steam as an ordinary boiler of three times its size usually produces. 2ndly. To reduce the consumption of fuel, so that only one-sixth of the quantity of wood usually required will be necessary. 3d. To overcome as much as possible the dangers arising from the bursting of boilers under high pressure. 4th. To render the boilers durable. 5th. To afford the greatest convenience for cleaning boilers. 6th. To prevent the crust from forming on the internal surface of the boilers by the sediment from the water, whereby a great obstacle is created to the heat. 7th. To create an almost instantaneous heat. 8th. To burn and decompose the smoke, the flame having to pass through pipes intended to convey off the smoke."

Kettles for factories of all sizes and descriptions, stills, and other similar apparatus, are to be constructed on the proposed principle.

The furnace has nothing peculiar in its structure. The upper part of it is covered with a plate of cast iron, perforated in the centre to receive a conical or cylindrical cap, into which the flame and smoke pass. The iron plate extends out horizontally to a considerable distance, to receive the *bell* and *dome*, which form the *boiler*. The piece called the *bell* is placed over and surrounds the cap, allowing a space of some inches between the two. The lower edge of the bell is secured steam tight to the iron plate. Over the bell is placed another covering, nearly hemispherical, called the *dome*; this is secured to the plate in the same way with the bell. The space between the bell and the dome is to contain the water which is to be boiled. The flame and smoke pass up through the cap, then down between that and the bell, and then again up, through pipes which are made to pass through the water, and have their exit at the vertex of the dome. This is the *steam boiler*.

A *stove* is described, which, by the aid of concentric cylinders and drums, is supposed to offer all the advantages ascribed to the steam boiler. We are unable to perceive in what way the above described boiler and stove are to attain all, or indeed either, of the proposed ends, nor does the description lend us any aid in this respect.

The claim is in the following words.

"The *principle* I claim, is, to concentrate the heat, by causing it to travel upwards and downwards through narrow passages, and to be conveyed by pipes of any length, and through any substance or matter."

Whatever merit or utility there may be in the apparatus described,

appears to be completely lost sight of in the claim, and the naked principle, or rather plan of conducting heated air upwards and downwards, through narrow passages, which is perfectly familiar to all persons conversant with the subject, is set up as new.

12. For an improved *Grist Mill*; Aaron Porter, New London, Jefferson county, Indiana, March 10:

The patentee has denominated his patent "an improvement in the art of milling," and then gives the "construction of the said machine." The said machine is merely a small grist mill, in which the lower stone is to be the runner; and we are told that by increasing the velocity of the stone, one of twenty inches diameter, may be made to perform as much work as one of 40 inches upon the old construction. There is no novelty whatever in the plan of this mill, and the specification is made in accordance with this fact, as there is no attempt to point out any, and consequently no claim.

13. For a mode of *Manufacturing Woollen Slubbing* at one operation, direct from the card; Charles Atwood, Middletown, Middlesex county, Connecticut, March 10.

(See specification.)

14. For an improvement in the *Manufacturing of Bench Plane Irons*; William Hovey, Boston, Massachusetts, March 10.

Steel is to be welded on to a bar of iron, extending its whole length; this bar is then to be rolled down to the thickness of the thick part of a plane iron; it is then to be cut into proper lengths and passed through eccentric rollers, so formed as to give to the iron its proper taper, after which the finishing is effected in the usual way. The claim is to the giving of the taper by eccentric rollers.

15. For an improvement in the *Frame Bridge*; George W. Long, of the United States Army, Fort Jackson, Louisiana, March 10.

(See specification.)

16. For an *Oval Churn*; John Oothout, Lebanon, Madison county, New York, March 10.

This churn has two vertical shafts with dashers, fixed in the manner of that represented and described at page 261, vol. ii. new series, patented by Joseph Hathaway, August 23, 1828. That churn it was proposed to turn by whorls and a band, but the one now under consideration has, instead of whorls, a cog wheel at the upper end of each shaft, which take into each other, and, of course, turn reverse ways. To these cog wheels motion is given by a vertical wheel, which meshes into one of them, and is turned by a crank; it is essentially

the same as the former churn in its internal structure; the only difference being in the substitution of cog wheels for whorls and bands.

17. For improvements in the *Plough*; Robert Walker, Washingtonville, Columbia county, Pennsylvania, March 10.

The specification describes the whole plough; the improvements claimed are as follow.

“The improvements for which I claim a patent, are, 1st. The deep locking of the joint between the land side and mould board, by which the mould board and land side receive mutual support. 2nd. The brace which confines the sheath in its proper angle, passing through the beam in front of the coulter. 3d. The curved form of the coulter.”

It may, and often does, answer the purpose of a manufacturer to have the name of *patent* attached to the productions of his workshop, and this is undoubtedly the motive, in many instances, for obtaining one; in such a case the manner of curving a coulter, fixing a brace, or strengthening a joint, may serve to fill up a form, and make a claim.

18. For a *Machine for Cutting Crackers, Sugar Biscuit, or other Bread*; James Cooper, Philadelphia county, Pennsylvania, March 11.

Cutters of an hexagonal form are united so as to cut nineteen or more crackers, or other biscuits; pricklers and clearers being fixed as usual. The dough is to be placed upon a platform; the cutter is then brought down on it, and pressure made by lever, or other power.

19. For a machine for *Washing and Cleaning Hats*; William Carlock, Baltimore, Maryland, March 12.

Two cages formed of ribs, which are elastic, are made to revolve horizontally, by any suitable means, in a trough containing water. Within these cages the hats to be washed are placed. The patentee says,

“What I claim as my peculiar invention, is, the application of machinery to the purpose of washing and cleaning hats of all superfluous colouring matter, and particularly for the use of springs, or slides, in the construction of a machine for the purpose; as also for all other parts of the machine described in my specification.”

This claim is much too broad and indefinite. In the first place, the washing of hats by machinery is claimed. If this can be sustained, certainly nothing more is necessary; this, however, is rather hazardous. The claim to all other parts of the machinery is a claim to cranks, cog wheels, &c., without regard to any particular combination, and must, therefore, be taken to mean nothing.

20. For an improvement in the *Making and using of Printing Types*; Lemuel Blake, Boston, Massachusetts, March 12.

The improvement claimed "consists in the uniting of two or more letters on one type body; the said two letters so united forming or composing a word in the English language, as well as being component parts of an immense number of other words, and consist of the following, viz. am, as, at, by, do, he, if, is, it, me, my, no, so, up, us, ye, we. And also the following not composing words, but of frequent occurrence, viz. ed, er, ll, ss, qu."

A plan of the case to hold the extra types accompanies the specification.

On the 9th of February a patent was granted to William Collier, of Boston, the principle of which is precisely the same with the foregoing, and embracing in the enumeration of combined letters the whole of the above, with the exception of four. We must leave the patentees to settle the question of which, or whether either, is the true and original inventor. To the printers will belong the determination of the extent to which such combinations may be carried, without extending their cases to an inconvenient size, or rendering them too complex. It is only for particular combinations, that patents can be claimed, (we will not say sustained,) as the practice of combining two or more letters is as old as the art of printing.

21. For an improvement in the *Bee Hive*; Ebenezer Beard, Charlestown, Middlesex county, Massachusetts, March 12.

The hive recommended is a double, square hive, one compartment being placed upon the other, with a division between them. In the upper division there may be four different compartments, formed by four separate boxes, which are placed with their mouths downwards. The communication between the upper and lower compartments may be opened or closed by means of slides; they are left open until the bees have filled a box with honey, when the slide is closed, and the bees within the box confined there; after "a few hours the bees in the box will become tame and harmless, in consequence of being shut out from their queen. The box may be then removed by lifting it out of the chamber, and setting it by, inverted;" the bees will return to the hive, the box may then be emptied and replaced, the slide drawn out, and the work proceed as at first. So says the patentee. There is no claim.

22. For a *Horizontal Water Wheel*, called the "Union Water Wheel;" John R. Wheeler, Pittsford, Monroe county, New York, March 15.

A wheel of six feet in diameter is selected for the purpose of giving a description of the proportionate measurements of one of any other dimensions. Two rims are made, each eleven inches in depth, the outer rim forming the exterior of the wheel, the inner one of such diameter as to allow a space of nine inches between them; this

space is to be occupied by the buckets, which are recommended to be of iron, and are to be let into each rim, in grooves of half an inch in depth. The buckets are not to be inclined planes, but are to be curved. The inner framing of the wheel consists of four pieces of plank, which are halved and grooved together, so as to leave a square hole for the vertical shaft to pass through, whilst their ends project out, and form the arms which are grooved into the inner rim. The claims are to

“1st. The manner of making and putting together the arms.”

“2nd. The iron buckets.”

“3d. The shape of the buckets.”

“4th. The manner of letting them into the rims.”

We see no novelty in either of these, excepting it may be in the third, and in this nothing with the exception of the *particular kind of curve* designated, which may certainly be departed from without injury to the wheel, and probably with advantage.

23. For a *Thrashing Machine*; Rudolph Miller, Marietta, Lancaster county, Pennsylvania, March 15.

This is another variation of the kind of thrashing machine most commonly patented. The beaters, which form the outer part of a revolving cylinder, are made to slide in grooves in the circular heads to which they are attached, so that they may give way when they strike the straw. The hollow segment is formed of iron bars, let into, and supported by, wood. The claim is to “the machine as before described; the cylinder of beaters with the mode in which they are made to rise and fall in their dovetail openings. Also the mode in which the bed is constructed.”

24. For a machine for *Cutting Crackers, Sugar and other Biscuits*; Thomas Bladen, Philadelphia, Pennsylvania, March 16.

This differs from the cutting apparatus No. 18, patented five days previously, in making the crackers, &c. round, instead of hexagonal. In that plan there was no waste dough between the biscuits, but in the present, triangular pieces must be cut out between the joinings of the circles. The bed of the press upon which the cutting is to be effected is formed of a plate of metal which is pierced entirely through to allow of a passage for the waste dough into a receptacle below; the circular parts which are to support the cracker being left solid. An upper steel plate, of two inches in thickness, forms the cutter; this is perforated with nineteen circular holes, of the size of the biscuit, the triangular spaces between them being left solid; the perforations are in the cutter, and, therefore, the reverse of those in the bed over which it is to be placed. The press used has the necessary fixtures for placing the cutter so that it may, with perfect accuracy, be pressed down upon the bed.

25. For an improvement in *Quadrants and Sextants*; Phineas Spear, Portland, Maine, March 19.

The apparatus described is to be attached to the off limb of a quadrant, or sextant, by means of suitable pieces of metal, which are to sustain "a fog glass," that is to stand vertically, and opposite to the horizon glass and tube of sight. "A horizon bar" is to be fixed across this glass, and a *spirit level* stands upon one of the pieces of metal which attaches the fog glass to the limb of the instrument. Adjusting screws are placed to regulate the level, the fog glass and the horizon bar.

"*Use of the apparatus.*—The *horizon bar* in the *fog glass* having been adjusted to the horizon by observing through the tube, or sight, (whilst the bubble is in the centre of the level) that the horizon bar is in the plane of the observer. The observer then brings down the celestial object in the usual way, till it touches the horizon bar, observing at the same time to keep the instrument level, by means of the level," &c. &c.

The advantage contemplated, is, the taking of the altitude of the sun, &c. in hazy weather. The claim is to the fog glass, the horizon bar, and the use of the level.

A careful adjustment is requisite, even with a fixed instrument, such as a theodolite, to place it perfectly level; how this can be effected by a quadrant or sextant held in the hand of the observer, we cannot perceive, and are convinced that the present plan will add one to the unsuccessful attempts at forming an artificial horizon.

26. For machinery for *Dressing Staves and Heading*, for barrels, casks, &c.; Abner Stearns, jun. Schaghticoke, Rensselaer county, New York, March 22.

The specification of this patent occupies twenty-eight closely written, foolscap pages, which we have not yet found time to read. We will take it up at an early day, and should we in the multitude of words in which the description is enveloped find any new ideas likely to benefit the formers of barrels and casks, we will endeavour to convey them in fewer words.

27. For a *Churn*; George Sowle and Peter Brewer, Blenheim, Schoharie county, New York, March 22.

Dashers are to be turned horizontally in a vertical churn, by means of a cog wheel and pinion. There is nothing to claim, and nothing claimed.

28. For an improved *Boot Crimp*; Jonah Brewster, Worthington, Hampshire county, Massachusetts, March 23.

This boot crimp is a sort of double pincers, to be used with the common *boot crimper*. The crimp is in form something like a staple, with a space between its two straps, or sides, sufficient to embrace the crimper. The leather is secured to each of these straps, by a second strap hinged, one on each, and screwing down so as to embrace the leather like a vice, or pincers. A long thumb screw passes

through the head of the staple, and bears upon the edge of the crimper, and by turning this screw the crimp recedes, and the leather is drawn to the desired form.

29. For a *Machine for Thrashing* and cleaning grain; Thomas Ingersoll, Murray, Orleans county, New York, March 23.

We will first give the claim made by the present patentee, which is as follows.

“The cast iron shell of the cylinder, with cast iron teeth solid on the shell, and the shape of the teeth; the rake, and riddle, and grates, and the manner of uniting the winnower to the thrasher so as to perform the thrashing and winnowing at one operation.”

The general construction is the same as usual; the cast iron shell, is what we have usually called the concave segment; the rake, and the winnower, which are attached, have been repeatedly combined with the thrashing machine, and that in a manner so nearly resembling the present as to render all claim to novelty very doubtful.

30. For a *Thrashing Machine*; William Corwith, New York, March 23.

There are feeding rollers and a revolving cylinder which carries the beaters, as usual, but the beaters instead of being bars extending from one end of the cylinder to the other, are rows of short flails connected to such bars by means of staples and thongs, allowing them to play freely. These flails are about six inches in length, and strike upon a bed, or floor, upon which the grain is fed by means of rollers. The claim is to the general *merits* of the machine, “and more especially for the manner in which the flails are appended to the cylinder, and operate during each revolution.”

31. For improvements in the *Fanning Mill* for cleaning wheat, rye, oats, &c.; David Sears, Franklin, Delaware, county, New York, March 24.

This fanning mill does not differ materially from those in general use, but is supposed to exhibit an improved arrangement of certain parts, pointed out in the following claim.

“*First.* The construction of the shoe which receives the grain from the hopper, by the insertion of wires in such a manner as to prevent the straw and heads of grain from obstructing the riddles.”

“*Secondly.* The apparatus communicating the vibratory motion to the shoe containing the riddles.”

“*Thirdly.* The general form of the machine, caused by such a disposition of its several parts as to render the whole more light and compact than any machine before invented for the same purpose.”

32. For machinery for *Sawing Clapboards*; Ebenezer Carlton, of Bath, and Solomon Whiting, of Littleton, in the county of Grafton, New Hampshire, March 25.

The same name is used in different parts of the country, for very different articles, and this of course has a tendency to lead persons into error; the term clapboards, in many places, means rough shingles, or other rived boards; in the present instance, feather edged weather boarding is the article intended. Mr. Eastman, of New Hampshire, obtained a patent for cutting weather boarding of this description from a round log by means of a circular saw, the log being sustained on centres so that it might be turned round, and the plank cut in radii towards its centre. The saw used in the present machine is also circular, but the weather boarding is to be cut from a log first prepared at a common saw mill, where it is to be cut of a thickness equal to the width of the intended weather boarding. The log so cut is to be placed upon a carriage which is to be made to advance by means of a rack and pinion much in the usual way; the log, however, is fixed upon rockers, contrived for the purpose of canting it, at the end of every cut, so that a thick and thin edge may alternately be formed at each surface. From the employment of this contrivance the patentees have named their machine the "*Tipping Clap-board Machine*."

There is not any part specifically claimed, and for want of a better drawing the description is imperfect, although it is manifest that pains have been taken to explain it in words. The drawing is in fact wretchedly executed. Patentees are not generally aware that according to our law, the drawing makes *a part of the specification*.

33. For a *Still Spindle and Can Roping Machine*; John Irwin, Coventry, Kent county, Rhode Island, March 26.

The arrangement of this machinery resembles that of the "*Can Spinner*," patented by Mr. John Thorpe, of Providence, Rhode Island, (see p. 65, vol. iv. new series,) as will be seen by the following description, abstracted from the specification of Mr. Irwin's patent. A still spindle has a case, or can, which may be of tin, fixed to the top of it; the can in use is said to be about 7 inches deep, and four inches in diameter. A spool is made to run on the spindle by means of a band, which spool receives the roping from rollers in the common way. The spool is made to rise and fall within the can by means of a waive rail. It is stated that "bobbins for *weaving*, and for other purposes, may be filled also in this same mode."

The claim is to "the *application* of the above described machine to *making roping*."

It would seem from the foregoing claim that it is not intended to represent the invention as new, but merely the application of it to roping. We should doubt the validity of this claim, as the machinery itself is patented by Mr. Thorpe, who says, "the improvements consists of a cup, or can, placed on the top of a dead, or still spindle, around the surface of which the yarn revolves, being drawn by the bobbin as it twists and receives it." "The bobbin may be either a *weaver's* bobbin, or a common spindle bobbin."

The drawing is without written references; the part intended to

represent a spindle would never be taken for one, nor is the manner of fixing the can, shown.

34. For machinery for *Bending Wagon and other Tire*; Lester Butler and Isaac Hinkley, Cobleskill, Schoharie county, New York, March 26.

The whole of the specification is comprised in the following words.

“Instead of having the bed and notch pieces, on which the under rollers run, stationary, and the rollers varied by moving them on said notches, which are an inch or more apart, as those in use are, the under rollers are regulated by placing them on slides, with one notch on each slide, which are moved by means of a screw on each end of the bench or platform, on which the slides and rollers are placed. By this method the under rollers may be varied so as to bend to any diameter you please.”

The drawing affords little or no aid in explaining the machine; the general nature of the improvement, it is true, may be collected from the above brief description.

35. For a plan for *Propelling Land Carriages by means of Steam*; Simon Fairman, Nassau, Rensselaer county, New York, March 27.

The specification and drawings belonging to this patent have been prepared with much care, and occupy considerable space, as the structure of the carriage, the propelling machinery, and the steam engine, are all particularly exemplified. To make known these particulars would require the whole specification with its drawings. It is well known that in England several different engineers have been for some years engaged in endeavouring to effect the object for which the present patent is obtained, and that a carriage has actually run to a considerable distance on a common turnpike road, surmounting the ascents, and carrying considerable weight; still the invention is far from complete there, although more has been done than we formerly believed to be possible, and the practicability of running a carriage upon good roads has been demonstrated. We are of opinion that it would have been more prudent to wait for some further experiments at the expense of those who have the thing in hand there, than to commence here a similar career, which will undoubtedly cause the expenditure of large sums, as many abortive essays will be made before complete success is obtained; more *good luck* than usual must be experienced should not this be the case.

From our recollection of some parts of the carriages constructed in England, we are apprehensive that there are claims made by the present patentee, with which they will interfere; we also think some of the claims too broad, they are as follow.

“The parts which I claim as composing the several items of this my improvement, are the *platform* with all the variations which may be necessary to adapt it to each and every kind of land carriage, together with all the superstructure herein specified; the *hind wheels*

and revolving axle, and all the intermediate machinery between them and the steam engine, together with the *ratchets*, the *friction band*, and *expanding corks*; the steam engine so far as it differs from those in common use, and the boiler and generator."

36. For *Generating Steam for Distilling*, and other purposes; John White, Logan county, Kentucky, March 29.

The apparatus intended to be patented is obscurely described, and but indifferently drawn. It is to consist of a wooden cylinder made in the form of the cylindrical boiler of a steam engine, but only 3 or 4 feet in length. An iron cylindrical furnace is inserted in one head of the boiler, in the manner which has been frequently practiced; from this furnace, flues lead backward and forward through the liquid contained in the wooden cylinder. The claim is to "the particular arrangement of the above named apparatus, and also the application of it to the distilling of spirits."

37. For an improvement in *Trusses for Ruptures*; Seymour Marsh, Canajoharie, Montgomery county, New York, March 29.

There are two pads attached to a steel spring of the ordinary form; one pad to bear against the rupture, the other against the back. The front pad is hinged to the steel spring, and has a small spring attached to the iron plate which forms the back of it; this spring, at its opposite end, bears upon the hinge, upon which it acts by means of a small friction roller. The hinge is attached to the truss spring by a screw and nut, sliding in a slot, to adjust it so as to fit exactly on the part required. The back pad is also adjustable by means of a nut and endless screw. An elastic strap passes round the side of the body opposite to the truss spring, to which it is attached by buttons in the usual manner. The claim is to "the action of the spring aforesaid, fastened to the front pad, upon a friction roller, to adjust the same; and the endless screw which governs the rear, or back pad, and which by the assistance of the screw can be moved at pleasure to avoid friction at any one place."

The drawing is sufficiently well executed, but is without written references.

38. For an improvement in the *Manufacture of Hats*, consisting in the stiffening thereof; Samuel W. Williams, Elizabethtown, Essex county, New York, March 30.

The process employed is similar to that now extensively used, in which shellac is dissolved in an alkali, applied to the hat in this state, and the alkali neutralized by sulphuric acid. In the present instance, however, copal and rosin are added in certain proportions, and it is said that this plan is more economical than that generally followed. The claim is to the adding these two resins; the mode of combining them; the relative proportions in which they are used; and to the mode of applying the stiffening.

39. For an improvement in the *Fluked Harrow Tooth*; Samuel Tam, Milton, Sussex county, Delaware, March 30.

The patentee says, "what I claim is the making the flukes of cast iron; hollowing or curving them near the middle; also in curving the shank, and giving it a sharp edge; by means of which improvements the flukes work clear, and wear sharp; also the shanks being sharp, cut the earth, and never clog after they are worn bright."

Excepting the giving to each side of the fluke a form something like that of the mould board of a plough, and the making them of cast, instead of wrought, iron, the whole harrow is of the common construction; the change from wrought to cast iron, we apprehend, cannot be sustained. The fluke as shown in the model and drawing, has its cutting angle so obtuse, as to present a resistance which must make it very hard to draw excepting in a very light soil. It may be an improved harrow, but to us it does not wear the appearance of being so.

40. For machinery for *Cutting the Screws of Gimblets*; Charles Daniels, assignee of William W. Southworth, Saybrook, Middlesex county, Connecticut, March 30.

A burr, buzz, or cutter, of cast steel, grooved on its cutting edge so as to form two cutters, is made by proper means to revolve on an arbor. The gimblet to be cut is held on the end of another arbor, which has vice-jaws for that purpose; the axis of this is somewhat inclined to that which carries the cutters. The back end of this arbor has a male screw formed on it, and passes through a collar with a female screw, so that when the arbor is turned by means of a crank, the point of the gimblet advances against the cutters which form the double screw at one operation. The claim is to the cutting the double screw at once; a similar machine, with a single screw, having been heretofore in use.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in the Construction of Clocks. Granted to JAMES BOGARDUS, New York, March 2nd, 1830.

To construct this clock, he makes a wheel, which he calls the first wheel, to carry the hour hand, revolving twice in a natural day; and he gears with this a pinion which shall throw another wheel, which he calls his second wheel, twenty-four times round while the first revolves once, being twice as fast as the minute hand should revolve, running of course in the contrary way from the hour hand wheel.

Then he gears a pinion of twice the number of teeth with the pinion on the axis of the second wheel, which pinion of twice the number of teeth as aforesaid, running the right way, will give the

minute hand fixed to its axis the proper number of turns, or seven hundred and twenty, to the single revolution of the hour hand wheel as aforesaid. The said second wheel being geared by the pinion aforesaid to the hour hand wheel, and revolving twenty-four times, as aforesaid, by means of the pinion, must be made of such diameter and number of teeth, and be so geared with the scapement wheel, which said Bogardus calls his third wheel, by means of a pinion on the axis of said scapement wheel, as to throw round the said scapement, or third wheel, thirty times at each turn of the said second wheel, and thus all the hands fixed to the said three axes respectively, will revolve together the required number of times. For convenience, the axis of the wheels and pinions are placed vertically above each other, the hour hand lowest, and the second hand highest. The wheel that carries the hour hand has a tube fixed in its centre through which the axis of the barrel is made to operate. The barrel secured to its axis, is connected with the hour hand, or first wheel, by a click on this wheel, which takes into a ratchet wheel fixed to a barrel. The axis of the barrel must be made with a square on its outer end, outside of, or within, the tube of the hour hand wheel, or first wheel, on which square, by means of a suitable key, the clock is wound up.

The principle of this improvement, or invention, consists in this, that the wheel which carries the hour hand, as aforesaid, and the barrel for the chain, or cord, or main spring, turn on a common centre and are combined with the two other wheels and three pinions constructed with such relative proportions as aforesaid, that the three hands marking the hours, minutes and seconds, shall be carried on three several axes as aforesaid, by a weight or spring applied to the barrel, and a pendulum or balance applied to the scapement wheel in any common form, so that the hands shall mark with precision their respective portions of time.

Clocks have been made with three wheels before, and of these a description is in Rees' Cyclopaedia; but no clock has ever been made with three wheels to carry the three hands, or the hour and minute hands only, so that the said Bogardus contemplates the application of his principle for the construction and application of the aforesaid combination, to effect the motion of the hour and minute hand, as well without as with the second hand.

The said Bogardus further specifying the principle of his invention, observes, that he does not include, as an essential part of his invention, any particular forms or positions of the parts, nor any particular mode of construction in common use of known parts of horological machinery, these being susceptible of great variety without difference in principle, but he claims the application of the principle of his combination to all machines for marking portions of time, whether of the larger kind, as clocks, or of the smaller kind, as watches, or of those called chronometers.

JAMES BOGARDUS.

Specification of a patent for an improvement in the construction of Iron Wheels for Rail-road Carriages. Granted to JOHN FINLAY, Baltimore, Maryland, March 4, 1830.

THE wheel consists of, 1st, the hub, 2nd, the spokes, 3d, rim, or tire, 4th, screws, bolts, or rivets, by means of which the bolts are secured.

1st. The hub is cast of iron, brass, or any suitable metal, with the grooves to receive the spokes cast in it.

2nd. The spokes are made of wrought iron, or any other suitable metal, round, oval, or any other figure. One end of each spoke is made to fit into the groove in the hub, before mentioned; the other end is made to fit to the flanch of the rim of the wheel, and secured by bolts, screws, or rivets.

3d. The rim, or tire, has a flanch on the inner side, in or near the centre, to which the spokes are secured; it has likewise another flanch on its periphery to adapt it for rail-roads; the whole is made, or cast together.

The different parts of the wheel having been prepared, the spokes are fitted into the grooves in the hub, and secured in their places by bolts, screws, rivets, &c. The other ends of the spokes are fitted to the flanches, and also secured in their places by bolts, screws, rivets, &c.

Invention claimed.—What I claim as my invention or discovery, are the wrought iron, or other metal spokes, with the manner in which they are secured to the hub and periphery of the wheel, and by which they brace and strengthen the wheel.

JOHN FINLAY.

Remarks by the Editor.—In the drawing accompanying the foregoing, the spokes are represented as double, one rising behind the other from each end of the hub, and uniting at the flanch within the rim; this, however, is not mentioned in the specification, and as it is a well known plan, does not, we suppose, make any part of the patent. We do not in this wheel perceive any improvement upon some others which are now in use. If the whole wheel is to be made of cast iron, it would be cheaper, and more firm if cast in one piece. All danger of breaking the spokes from unequal contraction in cooling is easily obviated by giving them a curved form. If the rim and hub are to be of cast, and the spokes of wrought iron, the plan adopted by Mr. Perkins obviates every difficulty resulting from the shrinking of the rim. He first casts the rim, with the wrought spokes inserted in it, and after suffering this to cool, so as to contract completely, he casts the hub, embracing the inner ends of the spokes. In this way any degree of lightness may be attained, combined with perfect solidity. We do not recollect having seen the description of the wheels patented in England by Messrs. Jones & Co., but from the manner in which they are mentioned, and from their having been adopted by Messrs. Braithwaite and Ericsson, in the carriage of their locomotive

engine the NOVELTY, we apprehend that they combine strength with lightness in an eminent degree.

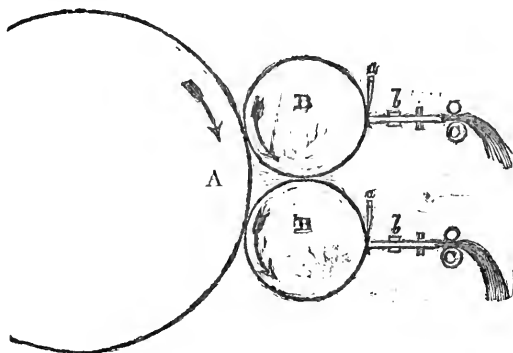
It frequently happens that in country places inventors have no opportunity of consulting Journals, or other works which would inform them that they have been anticipated in their inventions, or that even better things are known and used than those which they have devised. The world is large, and men in other countries possess genius, and are alive to the promptings of interest, whilst the press, in general, makes their inventions known at an early day; our large cities all furnish the means of information on such points, yet few of those who are interested appear desirous to avail themselves of the proffered advantage. It is no speculative opinion, but a fact confirmed by repeated observation, that individuals who think, or hope, that they have hit upon something new, are unwilling to be undeceived; we have known them refuse to look at a book, a specification, or a model which would have proved to them their error. This is not a rare, but a very frequent occurrence. There also seems to exist in the minds of many, an idea that when their contrivances are patented, this circumstance alone, independently of any intrinsic merit, will stamp upon them the evidence of absolute value. The greater number, however, of those who obtain patents, find to their cost, that they have purchased a barren field, the harvest from which will not be equal to the seed they have sown in it.

We have not made these remarks with particular reference to the preceding patent, which has merely served as a text, to enable us, like some others, to talk about things in general. We do not, it is true, as we have plainly indicated, think that it offers any *great* improvement, but those who are in the habit of reading our monthly lucubrations, are aware that we do not believe that great inventions or discoveries are numerous.

Specification of a patent for an improvement in the mode of making or manufacturing Woollen Slubbing at one operation, direct from the card. Granted to CHARLES ATWOOD, Middletown, Middlesex county, Connecticut, March 10, 1830.

THIS discovery or invention is an improvement on the wool carding machine as fitted for the common condenser, having two doffers clothed with filleting cards in such a manner that the space left between the fillets on the upper doffer are cleared by the fillets on the lower. The comb, and the tube or belts, or any other twisting apparatus, may be used conjointly to clear the doffers. And the improvement for which a patent is now prayed, consists in giving the doffers a motion exceeding that of the rolls or other apparatus which takes away the work; accumulating the wool by this means on the fillets of the doffers at the point where it is taken away. We are enabled to convolve, writhe, or twist it as it accumulates, and each turn as the wool accumulates lays the fibres of the wool in a spiral form,

leaving one turn of twist in the slubbing, and the degree of twist and the spiral form of the fibres will be as the difference of motion between the surface of the doffers and the rolls or other apparatus which draw away the slubbing, and may be varied to any degree sufficient for all the purposes desired or necessary for slubbing, and no condensing or rubbing is necessary to give it strength, and it may be packed on the large spool for the Jack, or on separate spools for the Brewster, or Jenny.



Suppose the arch A, to be a section of the main cylinder of the carding machine.

B, B, the two doffers moving as shown by the arrows.

a, a, the combs vibrating with a perpendicular motion.

b, b, the tubes.

C, C, the rolls for drawing away the work.

Now give the surface of B, B, and C, C, the same motion, and it is evident that the quantity of wool received on a fillet on B, B, at the point of contact with the main cylinder will be carried round until it meets with the twist given by the tubes b, b, and the stroke of the combs a, a, when it will be taken off by the roll C, C, just as fast as it comes to the tubes and combs, and the fibres of the wool will lie as they do on the doffer before the contact, and there can be no twist left by the tube, as the thread at each end will receive the same number of turns, and none will be thrown out; but increase the motion of B, B, say one third, and the quantity of the wool on the doffers between the point of contact with the main cylinder and the tube and comb will be lessened one-third, and as it is drawn away no faster by the rolls C, C, than before, it will accumulate at the tube and comb, and the motion of the tube will convolve or twist it as it accumulates, and cause the fibres of the wool to take a spiral position in the thread, and at each turn, in thus thickening and forming, one turn of twist will be left in the thread at the out end of the tube, and it will pass to the rolls C, C, and from them to the spools, just as heavy and large a thread as before the motion of B, B, was altered, but in the new form and twisted; and it will be obvious that just in

the proportion that the speed of B, B, exceeds that of C, C, will be the new result as stated above.

The advantages of this improvement, are, the laying the fibres of the wool more spirally, or more like the common roll from the card than any other method of making slubbing; it is consequently more easily opened and drawn in the spinning process, produces a finer and better thread, it receives all necessary solidity and strength from the twist without the injurious felting of the condensing rubber, the flannels from it felt better in the stocks, and the cloth finishes with less giging than that made by any other method heretofore known.

CHARLES ATWOOD.

Specification of a patent for an improvement in the Frame Bridge.

Granted to GEORGE W. LONG, of the United States Army, Fort Jackson, Louisiana, March 10, 1830.

THE object of the invention is to acquire great strength in a bridge by means of a frame work, which may be analogous to a given solid beam of such a shape as to support the greatest possible weight, when in a horizontal position: assuming that figure which will make it equally strong throughout. For such a beam of uniform width that which is semi-elliptical in its longitudinal direction possesses this property: and the invention here claimed consists in arranging a frame work to possess this property of the solid beam; or rather to acquire great depth, and consequently strength of beam, by having the frame so supported by posts and braces as to be firm and unyielding to a weight placed on it; by which can be obtained such strength as will answer for bridges of two or three hundred feet span.

The bridges now in use involving in any degree the principles of this invention are of different kinds; the most common, are a combination of the arch and frame constituting a crooked beam; and a late invention by Lt. Col. S. H. Long, of the United States Engineers, which is a straight beam; the ends and centres being the same in depth. All of the bridges here referred to differ entirely in the arrangement of the timbers and shape, from the invention here claimed and set forth.

The improvement in question consists in the reduction of a framed beam to the most simple and mathematical form, and such that it will contain no superfluous weight of material, and that each timber of the frame shall receive a portion of stress to support any weight placed on the bridge: and further, that this stress shall be in the longitudinal or strongest direction of them, either in thrust or tension.

The form of the framed beam may be an ellipse, a segment of a circle, or a triangle. The former is here assumed to explain the principles and mode of construction, which are as follows, and which are to be the same in each of the cases.

The framed beam consists, 1st, of a string piece made of one timber, or if more, they are to be joined with straps of iron so well bolted

through the timber as to make the joint as strong as the other parts of the string. The string extends the whole length of the span.

2nd. A set of posts, at convenient distances apart, are made to rest on the string, and made fast to it by straps of iron passing under it and well bolted to the bottoms of them. They are to be notched at the bottoms on each side, transversewise of the bridge, to receive sills on which the sleepers and flooring are to rest. The tops of the posts are to be furnished with small mortises on either side, the same as the cuts for the sleepers, to receive timbers which are to be supported between them. They are also to be notched under these mortises, on the outer sides from the centre, to receive the tops of the braces which are to stiffen and resist the crush of the bridge.

3d. A set of timbers joining the tops of the posts which are held in their places by small tenons and mortises. In the beam, they are to represent the upper edge or last point of fracture in a section.

4th. The braces are a set of timbers placed diagonally between the posts, all inclining inwards. The foot of each brace rests on the string near the bottom of each post, except the centre, and the brace then inclines to the top of the next inner post. It is to be cut with square notches at either end so as to receive any pressure it will bear, and not weaken, too much, the head of the post and the string piece. By these braces any weight placed on the bridge, which comes upon the posts, is distributed throughout the frame. A single-way bridge will require two of these beams, and a double-way, three. The sills, as before stated, are to rest on shoulder notches cut in the posts. They may also be so notched as to allow the two, to each set of posts, to come together and be trenailed, or clamped, tight to the posts. They are also to project over the sides of the bridge far enough to receive braces to stay the posts in their upright position. The posts must also be joined across the bridge at their tops by small timbers, which, with the last named braces, will render the bridge sufficiently stable. The sleepers and planking are to be laid as in ordinary flooring. The bridge should also be furnished with side railings, which may be made as fancy may require.

The material for construction may be wood, or iron, or a combination of the two. The strings may be of iron, and also ties, in opposite diagonals to the braces of iron, may be substituted for the braces. If a chain is used for the strings, an inverted position of the bridge may be assumed, in which the chain becomes the part corresponding with upper timbers in the other case, and a similar reversed position will also take place in the other timbers.

It will be seen that a weight placed on a bridge of this description causes a stress throughout all of its timbers in their strongest directions; thus making it a strong and economical mode of construction. It possesses the great advantage of containing no more material than is directly applied to give strength; as well as its being the most plain work of carpentry. The saving in expense of piers and abutments, not required to resist a thrust, must also be counted a material advantage, especially on soft and mealy soil.

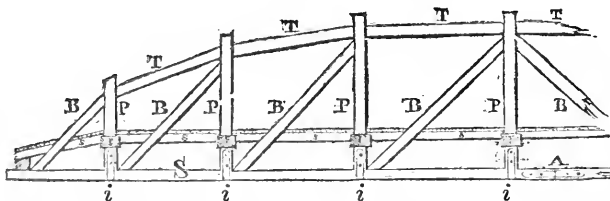
A further benefit claimed in the framed beam, is its use for support-

ing the roofs of houses or public buildings; by which a room of one or two hundred feet can be roofed without other supports than the walls.

A model ten feet long, 18 inches high, of $1\frac{1}{8}$ inch cypress timbers, supported fourteen men, whose weight amounted to 2140 lb.

GEORGE W. LONG.

Fig. 1.



PLAN OF THE ELLIPTICAL FRAME BRIDGE.

Explanations of the above plan.

Fig. 1 is a side view of the bridge.

Fig. 2 is a vertical section through the centre posts.

S, S, &c. are strings, Figs. 1 and 2.

P, P, &c. are posts, Figs. 1 and 2.

i, i, &c. Straps of iron attaching the posts to the strings, Figs. 1 and 2.

B, B, &c. are the main braces, Fig. 1.

T, T, &c. timbers bracing the heads of the posts apart, Fig. 1.

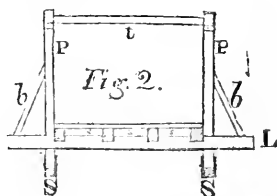
L, the sill of the bridge, Fig. 2.

s, s, &c. are the sleepers, Figs. 1 and 2.

F, is the flooring.

A, a joint in the string secured by straps of iron well bolted to the timbers, Fig. 1.

b, b, braces. t cross piece to steady the frame, Fig. 2.



Specification of a patent for a new and improved Paddle for Propelling Steam and other Vessels. Granted to JACOB PERKINS, Esq. Civil Engineer: a citizen of the United States, formerly residing in the City of Philadelphia, but now of the City of London, in England, November 30, 1829.

My improvement consists in the peculiar arrangement, use, and application of the paddle wheels of vessels, and of the shafts or axles for carrying and moving the same. The shafts or axles are placed as nearly as may be in an horizontal plane, and are so inclined towards each other, and towards a perpendicular plane passing through the keel of the vessel, that if produced backwards, they would meet

in such perpendicular plane, and form with it an angle of 45 degrees, and with each other an angle of 90 degrees, pointing towards the stern of the vessel. The shafts, or axles, being so inclined as aforesaid, pass obliquely forwards through the sides of the vessel, and the wheels being fixed with their planes at right angles to the shafts, look, or stand, obliquely forwards, and outwards, and as a consequence of that position of the axles before mentioned inclined from the sides of the vessel at the places near which they are applied. The floats, or paddles of the wheels, must be so set, or fixed, as that each of them shall stand at an angle of about 45 degrees to the plane of the wheel's motion, to the end and intent that each float, or paddle, when in the lowest part of its rotation, may make a right angle with the keel of the vessel, or act directly in the line of the vessel's way; and the uppermost paddle be parallel to that way, or to the keel. To effect these ends it will be necessary that all the paddles of the upper halves of both the wheels shall have their inner edges pointing backwards, or towards the stern of the vessel, and their outer, or extreme edges, in the direction of the vessel's way, or towards its head. The floats, or paddles, are fixed in the nave, or boss of the wheel, and radiate from its centre.

The practical effect of the above construction will be, that the paddles will enter and leave the water in an oblique direction, and that the lowest paddle will always move in the most advantageous manner for propelling, or backing the vessel, and the uppermost one be in the precise direction of the vessel's way, or parallel to the keel, and will meet with little impediment in its passage through the air, whilst the oblique position of the wheels, with reference to the side of the vessel, will give room for the water to escape. The oblique position of the wheels will increase the width of way required for the vessel, but this inconvenience may be diminished, if not wholly removed, by making the paddles of less width than in common paddle wheels, and by letting parts of the wheels into hollows made for the purpose in the sides of the vessel.

In my arrangement above described, the wheels may be much more deeply immersed in the water than in the ordinary arrangement of paddle wheels, which more than compensates for the loss of power occasioned by narrowing the paddles. In letting the wheels into hollows in the sides of the vessel, the only thing to be attended to is, that the inner edges of the paddles at the lowest point of rotation, must not be within the line of the ship's side at this part, but must be without, and clear of the sides of the vessel. The above description applies to vessels and wheels for sea use, in which case I apply the shafts and wheels one on each side of the vessel, placing them so that a line joining the centres of the wheels, would be in a perpendicular plane, passing through, or as nearly as may be through, or over, the centre of motion of the vessel, in order that the wheels may be removed from the water, or sunk into it as little as possible, by its pitching.

In river and coasting navigation, I use a single wheel formed as above, and fixed upon an oblique shaft passing out from the centre of the stern at an horizontal angle of about 45 degrees with the keel, the paddles being oblique, as above described, or placed at angles of

about 45 degrees with the plane of the wheel's motion, and in such manner that the lowest paddle may always move into a position at right angles with the keel, and, consequently, in that direction which will produce the most powerful action upon the water in the direction of the keel, either for propelling or backing the vessel, while the uppermost paddle will always be parallel to, or in a right line with, the direction of the keel.

The wheel may be made larger when placed in this position than in any other, and may extend so as to cover nearly the whole of the stern, and reach downwards nearly to the bottom of the keel. The position of the shafts, or axles, and the construction of the wheels as above described, are such as I consider the most perfect; but a trifling variation from such position, if rendered necessary by circumstances, will not affect the principle or utility of my said invention.

I am aware that paddles placed obliquely, or at different angles to the plane of the wheel's motion, have been used, and I therefore lay no claim to them, except only so far as they are necessarily used in conjunction with my aforesaid oblique, or angular, shafts, or axles, at the two sides of any vessel as aforesaid, or with a single large wheel fixed astern; and I then only claim them when the said oblique paddles bend, or incline, in the direction before specified; that is to say, with that side of the lowest paddle at right angles, or directly opposed, to the way of the vessel, or nearly so, and with the edge of the uppermost paddle in the direction of that way, or nearly so. When the oblique shaft and large wheel are used at the stern, as aforesaid, two rudders may be adopted, one on each side, or a single rudder at one side only.

JACOB PERKINS.

DESCRIPTION OF THE DRAWINGS, PLATE V.

Fig. 1. The wheel as it appears in direct action, when viewing the boat on the beam.

A, the lower paddle, presenting its edge only to the eye, as it then forms a right angle with the keel, and exerts its full action upon the water.

B, the upper paddle, the whole face of which appears, as it stands parallel with the keel.

C, C, the intermediate paddles, the one about entering, and the other having emerged from the water.

Fig. 2. A birds-eye view of the wheel, the letters corresponding with those of Fig. 1.

Fig. 3. D, D, the wheels as fixed about the centre of motion of the vessel.

E, bevelled wheels gearing into each other, and by which the paddle wheels may be driven.

Fig. 4. F, F, the wheels placed in the bows.

G, A single wheel in the stern.

This last is to be considered as two distinct figures, and not as three wheels in one boat.

Remarks by the Editor.—In the number for January, page 42, we inserted some observations on paddle wheels generally, with a parti-

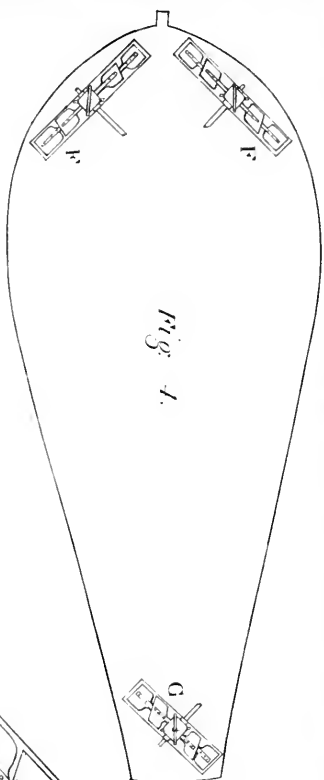


Fig. 1.

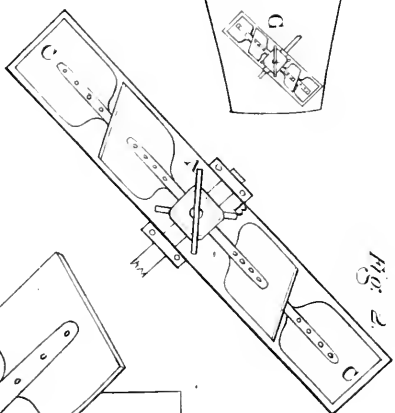


Fig. 2.

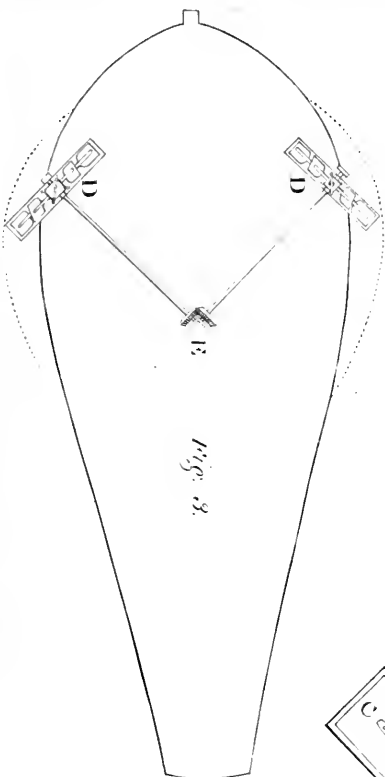


Fig. 3.

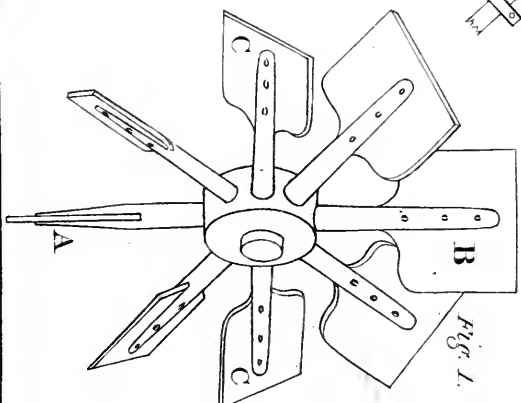
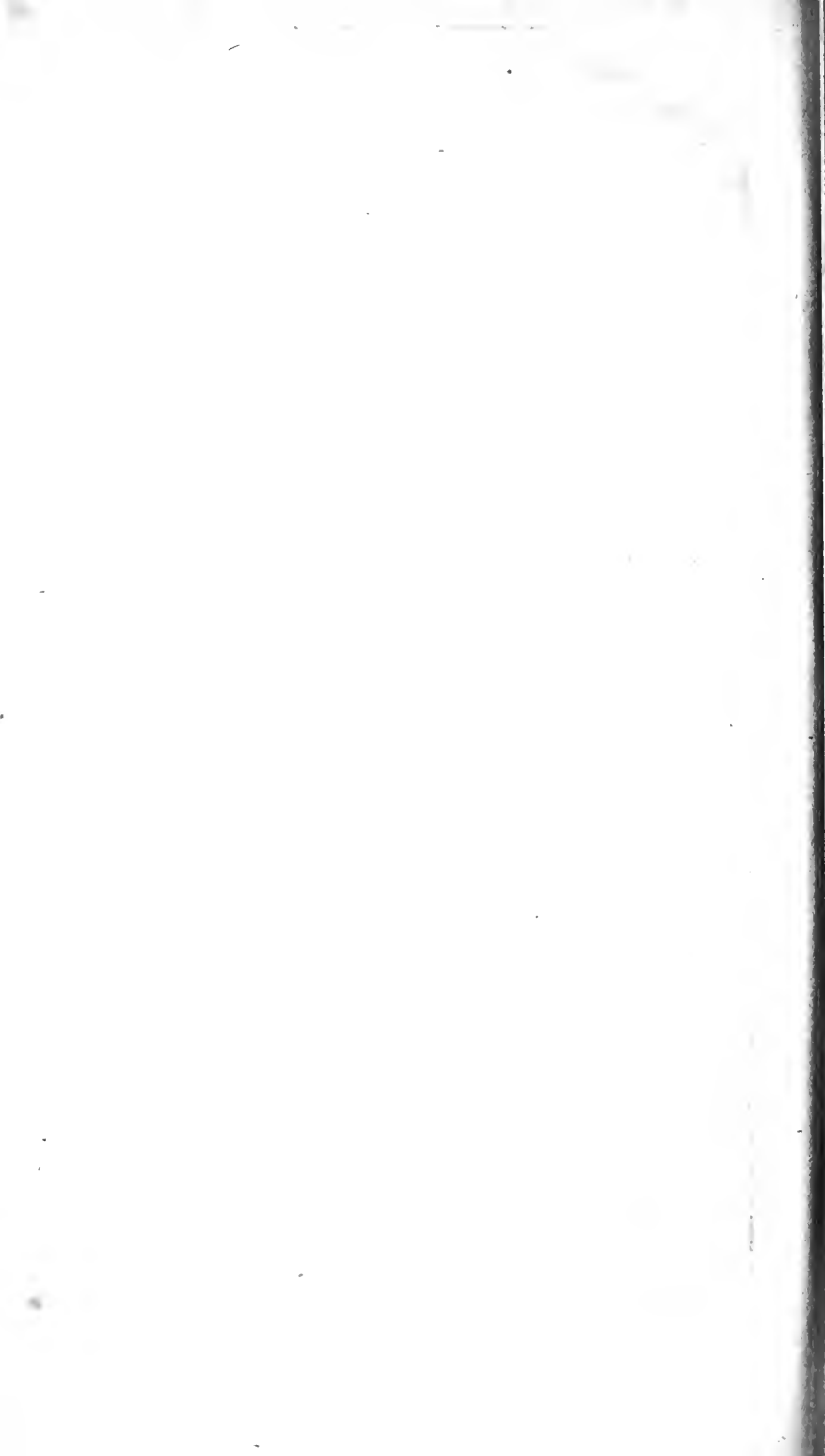


Fig. 4.



ular reference to those described in the foregoing specification; to that article the reader is particularly referred, as its object will be more clearly understood by the aid of the specification and drawings now given. Joseph Hall, Jr. Esq. of Boston, is the proprietor of this wheel, and from him we have expected to receive the result of some further experiments with it; the tardiness of workmen, and those other causes which usually concur in producing days and weeks of delay in such pursuits, have hitherto prevented this; we have determined, however, not any longer to defer the publication of the patent, and to present the expected additional information hereafter.

We believe that there are few persons who would not be posed, for some time at least, if simply informed that a paddle wheel had been constructed in which the buckets were firmly fixed to the axis, there being no revolution, or motion of its parts other than in the ordinary wheel, and yet that every bucket would, in its circuit, assume every possible angle with the keel, or rather with a vertical plane cutting the vessel from stem to stern; yet such is the fact as respects this wheel. Much ingenuity has been displayed in the numerous plans which have been devised for causing paddles to enter and leave the water more advantageously than in the common wheel, but their complexity, and consequent friction, and liability to derangement, have neutralized all the benefits which have been anticipated from them. Should the advantage produced by the present paddle wheel be, in its amount, but one-half equal to the ingenuity manifested in its construction, we think that it will prove to be the best, by far, which has been yet proposed. That we are not apt to be sanguine respecting the success of such projects may be deduced from the tenor of the observations which we have made in relationship to the numerous modes of propelling which have been patented here, and in England; as we have generally thought them inferior to the common wheel; but of Mr. Perkins' we hope better things, and feel a warm interest in the result of a fair experiment. The paddles will certainly enter and leave the water without producing any of that agitation in the boat which is felt from those ordinarily used, and which is only partially corrected by Stevens' divided wheel, an agitation which is equally unpleasant and injurious. A more rapid rotation must be given to this than to the common wheel, as the position of its axis will diminish the lineal velocity of the propelling paddles, in the direction of the boat's way.

There may, probably, be a valid objection to the increased width of the boat, or guards, consequent upon the wheels being placed amidships, as represented in Fig. 3. This, objection, however, will be completely obviated by placing them at the bow, as seen at F, F, Fig. 3, where only half the width of guard will be necessary. A further advantage will result from this arrangement; all the machinery will be brought forward, and a larger clear space left amidships, causing the vessel at the same time to steer with greater facility.

It has by some been apprehended that the oblique action of the buckets as they enter the water would tend to draw the wheel outwards, with a force which it would be difficult to counteract, and

which must produce very great friction on its bearings. This tendency of the dipping, is completely counteracted by the action of the emerging paddles. The truth of this has been proved by Mr. Perkins, in experimenting with a wheel in the stern, as shown at G, Fig. 4. When this wheel was used without a rudder, or any thing to direct the boat but the wheel itself, it was always propelled in the exact line of the keel.

ENGLISH PATENTS.

To JOHN DAVIS, Sugar Refiner, for a certain improvement in the condenser used with his apparatus for boiling sugar in vacuo.

Dated 2nd October, 1829.*

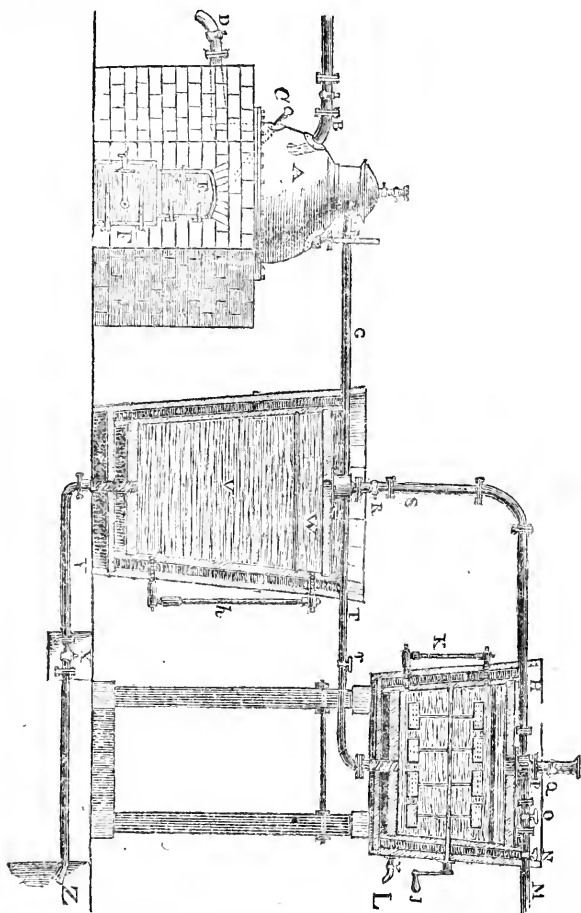
I, the said John Davis, do hereby declare the nature of the said invention to consist, in a certain improvement in the condenser used with the said John Davis's former patent apparatus for boiling sugar, whereby the necessary vacuum is not formed by the admission and eduction of water, as therein described; but by the introduction of steam from the boiler or pan into the condenser, thus doing away with the torrecellian column mentioned in the former patent of the said John Davis. And in further compliance with the said proviso, I, the said John Davis, do hereby describe the manner in which my said invention is to be performed by the following description thereof, reference being had to the drawing annexed, and to the letters marked thereon, (that is to say:)—

Description of the Drawing.

This represents a sugar boiling pan on the former principle, with the said condenser applied thereto, having such portions of the apparatus shown in section, as it was thought would give the clearest explanation of it. A, B, C, D, E, F, are the sugar pan, the feed pipe, proof stick, discharge cock, furnace, ash pit, &c. &c. all of which are too well known to need any further explanation; and G is the pipe which connects the pan with the said condenser, and is in fact, a steam pipe. H is a water tight vat filled with water, for the purpose of keeping the apparatus which is within it always covered with water, and thus air tight. I is a stout cask set into the vat H, with an agitator inside it, which agitator is turned by the handle J working in stuffing boxes to prevent the admission of air. K is a glass tube communicating at each end with the inside of the cask I, through the sides of the vat H, serving as a gauge to show the quantity of water in the cask. L is a discharge cock for the vat. M is a feed pipe supposed to lead from an elevated reservoir of cold water. N is a feed cock to fill the vat. O is a feed cock to fill the cask I through the pipe P,

* This is an improvement upon a plan patented in March, 1828, but the description is so generally repeated in the present specification, as to render the publication of the former unnecessary.—EDITOR.

and Q is an air cock to let the air escape from the cask as it fills. T is a supply pipe leading from the cask I to the condenser V, for the purpose of supplying cold water to the condenser, and R is a stop cock to regulate the supply.



Now this condenser is a large cask set within another cask, the outer cask being filled with water to keep the inner one air tight. W is a shelf of wood or iron perforated with holes to spread the steam when it first rushes into the condenser. U is a stop cock* to cut off the communication between the pan and the condenser. S is a steam pipe, which receives the steam from the pan A through the pipe G. Now this pipe S, it will be seen, communicates at its upper end with the cask, the effect of which is, that when the steam from the pan A is allowed to pass into the pipe G, a portion of the steam passes up the pipe S, and

* This must be in the pipe G, but is not shown in the drawing.

acts on the surface of the water in the cask, thus driving a portion of that water through the pipe T into the condenser, while the other portion of steam passes down into the condenser, and is there condensed by the water that is forced in as aforesaid. Y is a waste pipe leading from the condenser to the reservoir or waste place, Z.

Having now described the various parts of the said apparatus, I shall proceed to describe the manner of using the same, and the mode of creating and keeping up a vacuum therewith, during the process of sugar boiling.

The first thing to be done is, to fill the outer casing of the condenser with cold water, and also the vat H; then stop the cocks N, R, and r, and open the cocks O and Q, this will admit water from the elevated reservoir of cold water through the pipe M into the cask, and the pipes S and T, while the air that the water displaces will find vent at the air cock Q; when the cask is completely filled with water, the cocks O, and Q, are to be stopped, and the cock r opened, this will cause a portion of the water in the cask, and pipe S, to fall into the condenser, and when it has dropped eight or ten inches, which will be seen by observing the gauge or glass tube K, the cock r must be stopped again and the agitator in the cask must be turned round by means of the handle J, in order to disengage whatever portion of air may be in the water in the cask, and which will, by this means, rise to the upper part of the cask; the cocks O and Q must then be opened again, and more water admitted, which will again fill the cask, and expel the air that has been disengaged, by which means, the water in the cask will be as free from any portion of air as possible, and thus fitted for the purpose it is intended to accomplish. The cocks O and Q must now be closed again for the last time during the operation. When in this state, the apparatus is ready for the process of boiling and condensation to commence. The fire must now be lighted in the furnace, the liquor measured into the boiler or pan, and heated in the ordinary way. When the steam in the pan has been got up to a pressure of more than fifteen pounds to the square inch, the water in the condenser must be drawn off by the pipe Y, and the cocks U and X must be opened. The steam from the pan will rush into the condenser and expel what atmospheric air may be in it, and rush out of the waste pipe Y; when this is accomplished, shut the waste cock X, and open the cock R, and partly open the cock r; a portion of the steam will instantly rush up the pipe S, into the upper part of the cask, and thus cause a pressure on the surface of the water in the cask, while another portion will rush downwards into the condenser V, striking upon the perforated plate W, and distributing itself for condensation; the cock r being partly opened, the effect produced will be as follows,—the force of the steam which is passing up the pipe S into the cask, will act with sufficient force of pressure on the surface of the water in the cask, to force out as much as is required for the purposes of condensation through the pipe T and the cock r into the condenser V, which quantity may be regulated by the cock r; the cold water thus flowing constantly into the condenser, will condense the steam there, and the condenser must be of a size

to hold all the condensing and condensed water required for one operation, as this operation will continue till the whole of the liquor in the pan is sufficiently evaporated for the purpose of the operator. The general proportions of the apparatus as attached to an ordinary sugar pan, holding about fifty gallons are here shown, but as a useful general guide to the size of the apparatus, it is only necessary to observe, that the cask, should be large enough to hold sufficient water to condense all the steam that will be generated in one operation of the boiling pan, as it cannot be replenished during the process of boiling, and the condenser of the relative size hereinbefore shown. When the operation is concluded, it is hardly necessary to observe, that the water is drawn out of the condenser by the waste pipe Y, and the cask, again filled as before, for the next operation. *h* is merely a gauge to ascertain the quantity of water in the condenser.

Now whereas, I claim only as the invention, the following improvement, viz.—The substitution of the common waste pipe to the bottom of the condenser, instead of the torrecellian column, and an enlargement of the condenser to about six times the size of that required in the said John Davis's former apparatus, by which said improvement I am enabled to form the required vacuum by the introduction of steam from the boiler or pan into the condenser, as hereinbefore described, which does away with the necessity of the torrecellian column, and the consequent height of the apparatus above the well of waste water, which is often extremely difficult to procure, while it greatly simplifies the operation. *[Repertory of Patent Inventions.]*

To GEORGE STRATTON, Gentleman, for his invention of an improvement in Warming and Ventilating Churches, Hot-houses, and other Buildings; which improvement may be applied to other purposes.

Dated August 28, 1828.

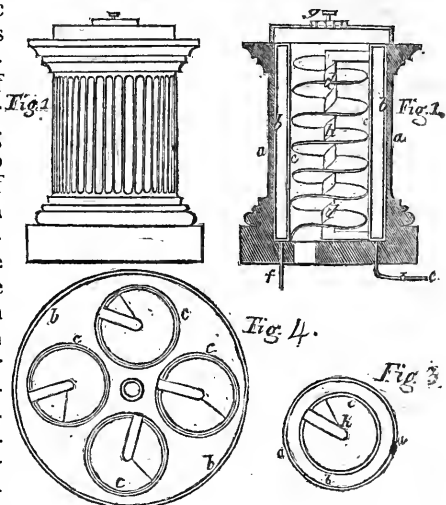
I the said George Stratton, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is described and ascertained as follows, (that is to say:)—

My improvements in warming and ventilating churches, hot-houses, and other buildings, consist in the construction of an apparatus having one or more spiral channels, through which atmospheric air is to be passed; these spiral channels being surrounded by a hot medium produced by a close vessel containing steam. The manner in which I construct my improved apparatus is shown in the drawing hereunto annexed, in which Fig. 1 is an external view of the heating apparatus; Fig. 2, is a section of the same taken vertically; and Fig. 3, a horizontal view of the same, the top being removed to show the interior. It is contained in a hollow pedestal, which may be of any convenient form dictated by fancy or taste; that is, circular, triangular, square, or polygonal. The most simple construction of the apparatus is that exhibited by the three first figures, in which the contrivance is adapted to a cylindrical chamber or box: *a a* is the outer case or hollow pe-

destal, enclosing the apparatus; *b b* is a cylinder within the pedestal, having another cylinder *c c* within it, which contains the spiral *d d*. The cylinders *b* and *c* are made of sheet copper, or any other suitable material, and being connected together at top and bottom, and the ends of the passage between them closed, form a close cylindrical box or channel for the reception of steam; a pipe *e*, which communicates with a boiler, conducts the steam into this cylindrical box or channel *b*, by which a heated medium is made to encompass the cylinder *c* containing the spiral *d*; and any water which may accumulate by the partial condensation of the steam, runs off to the boiler or elsewhere by the pipe *f*.

In the bottom of the pedestal there is an opening for the admission of atmospheric air, which, passing upwards, proceeds through the winding passage of the spiral, and becoming heated in its progress, is passed off at top into the open part of the pedestal, and thence is disseminated through the ventilator *g*, into the building or apartment intended to be heated. A perpendicular pipe *h*, passes up the centre of the spiral as a support to the several coils of the sheet metal, by which the winding passage is formed. This pipe communicates at top and bottom by means of short horizontal pipes with the steam chamber *b*, and by that means allows the steam to circulate through the centre of the spiral, for the purpose of assisting to heat the air in its progress. The ventilator is formed by two perforated circular plates sliding round upon their centre, or by other sliding apparatus of the same kind, by which the quantity of heated air passed from the apparatus may be regulated.

Having described the mode of constructing my improved heating apparatus, in its most simple form, I now proceed to state the manner in which I adapt several of these spirals in one pedestal or steam box, for the purpose of increasing the quantity of air heated, and passed through an apparatus of this description. Fig. 4 is a horizontal section of a circular steam box *b b b*, with four of the cylinders *c c c c* passed through it, each containing one of the spirals *d*, constructed with pipes, and forming spiral channels exactly as described with reference to Figs. 2 and 3. Any number of these spirals may be inserted in this way in a close steam box of any convenient shape; the steam being conducted from a boiler, and admitted by a pipe *i*, in the centre or elsewhere, and the atmospheric air being passed from



below through the spiral channels in the manner before explained, and discharged through a ventilator at top. [Ib.]

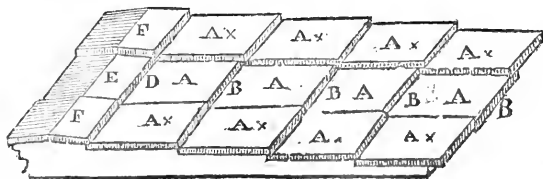
To ELIAS CARTER, Upholsterer, for a new Covering for the Roofs of Houses, and other Buildings. Dated October 11, 1827.

I the said Elias Carter, do hereby declare the nature of my said invention to consist in particular shaped plates of iron, or other suitable metal or material to be used in a regular series for covering the roofs of houses and other buildings; and in further compliance with the said proviso, I, the said Elias Carter, do hereby describe the manner in which my said invention is to be performed, by the following description of the said plates, and of the mode of placing the same for the purpose aforesaid, reference being had to the drawing annexed, and to the letters and figures marked thereon, (that is to say:)—And first of the particular shaped plates, which consist of three different forms, and which are shown in the drawings by Figs. 1, 2, and 3. Of these

Fig. 1 is what I call the roof plate, and is marked A; it is made with three of its sides turned up and one turned down; the side which is turned down in this figure, is marked B, and I call it, for the sake of distinction, the lip; this roof plate A, tapers narrower towards the lip end of it; by twice the thickness of the plate, the reason for which will be seen when the mode of placing the plates to form a roof is described.

To form the ridge of the roof, two kinds of plates are required, and Fig. 2 represents one of these plates, and Fig. 3 the other. The plate, Fig. 2, is marked E, and it will be seen has two sides marked C, C, turned up, and two sides marked D, D, turned down; this plate I call the low ridge plate, and the other plate, Fig. 3, marked F, I call the high ridge plate or cap plate; this plate it will be seen is in fact a mere cap, since all its four sides are turned down; it will be observed that both the ridge plates are made with an angle, sloping downwards each way from the centre; and it should here be observed, that the fall of these ridge plates should not be less than half an inch to a foot.

Fig. 4.



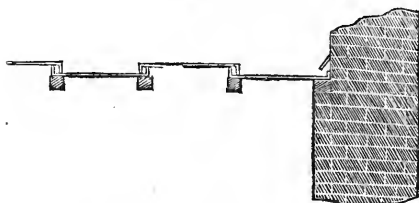
And now I will proceed to describe the manner of laying the said plates to form a roof, with reference to Fig. 4; this figure shows part

of a roof formed of the three kinds of plates hereinbefore described; the plates marked A and A × are all roof plates, those marked A, have the lip B placed downwards, and turned towards the eaves of the roof, while those marked A × have the lip placed upwards, and turned towards the ridge of the roof, and it will be observed they are laid in alternate rows; the plates marked A are first laid with the lip B lapping over the upper side of the plate next below it, as here shown, and which the tapering shape of the plates easily permits. The plates marked A × are next laid, a row on each side of the plates A, and lapping over their sides, and then the low ridge plate E, is laid; and last of all the high ridge plate or cap plate F, which completes the portion of roof. It should be observed here, that inasmuch as the high ridge plate F, is to lap over or cover over four edges of other plates, it should be made a little larger in its dimensions than the other plates, while the low ridge plate should, from its situation, be made a little narrower in the direction of the ridge; in fact, it should be of the same width as the roof plate at the lip or smaller end.

Fig. 5.

Fig. 5 is a section across the end of a roof, formed of such plates as aforesaid; and Fig. 6

is a section in the direction from end to end of such a roof, which two last figures clearly show how the sides and lips of the plates are to lap over each other.

Fig. 6.

Now whereas, I do not claim any particular metal or material of which the aforesaid plates are to be made, or any particular dimensions, but I recommend that the plates should be made of cast iron, and that they should be $\frac{3}{16}$ ths of an inch in thickness, and two feet square, with the sides and lips two inches deep.

And whereas, I claim as my invention, metal plates so formed, as aforesaid, with such sides and lips as hereinbefore described, and laid in manner aforesaid, for the purpose of forming a covering for the roofs of houses and other buildings; and such my invention, being to the best of my knowledge and belief, entirely new, and never before used within that part of his said majesty's United Kingdom of Great Britain and Ireland, called England, his said dominion of Wales or Town of Berwick-upon-Tweed, nor in any of his said majesty's colonies or plantations abroad; I do hereby declare this to be my specification of the same, and that I do verily believe that this my said specification doth comply in all respects fully, and without reserve or disguise, with the proviso in the said hereinbefore in part

recited letters patent contained, wherefore I hereby claim to maintain exclusive right and privilege to my said invention.

Observations by the Patentee.—The above described roofing is adapted to the covering of churches and other public buildings, as well as private dwellings and warehouses. It is particularly well calculated for the Grecian style of architecture, which requires the roof of a lower angle than can safely be given with any other than a metallic covering. The expense, compared with lead, is scarcely more than one-third.

By the contraction and expansion of metals in all changes of temperature, lead is very liable to fracture, and particularly so when confined, or laid in long sheets. The patent iron roofing being divided into figures of equal dimensions, the expansion or contraction is so equally diffused, and its quantity so divided, that no fracture can possibly happen from such cause. Taking into account the quantity of lead used on slate roofs, upon the ridges and angles, also the charges for laths, copper nails, &c. &c., particularly on buildings of large dimensions, in which the double or M roofs are required; considering also the saving of materials in the diminished surface, occasioned by the low angle, the iron will not be of more cost than a covering of the best slate, over which it has likewise the advantage in being of lighter weight. The slate roof may be calculated to last about fifty years; at the end of that period the old slate will be of no value, although the iron will in that time be scarcely deteriorated, and, in case of the final destruction of a building, the roof covering may be worth the original cost for its original purpose.

The effect produced by the simple and regular form of the parts composing this covering, is peculiarly pleasing to the eye, which is relieved by the light and shade produced by the alternate projection, the apparent thickness, and the gradation of the plates. It also presents a field for the display of architectural taste, in such buildings of classical design, as require that a participation of ornament be continued to the roof; or, that this part of the building be totally concealed from view. The roofing of the portico of the London University may be quoted as a specimen, being made exactly in accordance with one of the best examples of the ancient Greek style, excepting the honeysuckle ornaments of the ridge and eaves, which are omitted.

To illustrate the comparative weights of the different roofing materials generally employed, it may not be deemed irrelevant to the present subject, to give a table of them, as extracted from Tredgold's valuable work on the strength of cast iron.

Copper	-	-	-	100 lbs.	per square of 100 feet.
Lead	-	-	-	800	—
Large Slates	-	-	-	1,120	—
Ordinary ditto	-	-	-	900	—
Stone Slate	-	-	-	2,380	—
Plain Tiles	-	-	-	1,780	—

Weight of the proposed iron covering, 1,000 lbs. per square of 100 feet.

An objection having been raised against the cast iron covering on the score of lightning, a few words on that subject may be required:—Electrical experiments prove that metals are all conductors of electricity, the most pure and least oxidable standing first on the list as the best conductors. By this rule iron is not so good a conductor as copper and lead. It is a well known fact that our cathedrals, and many of the older churches, are covered with lead; and buildings without number, in all parts of the world, are covered with lead or copper. The inhabitants of districts where iron is raised and smelted, live without fear amongst immense quantities of that metal; nor is a thunder storm more destructive there than in other places. Iron has likewise been used near a century in the construction of bridges, and neither of them having yet been injured by lightning, is a satisfactory proof that iron is not more attractive of electric matter than any other metal. [Ib.]

FRANKLIN INSTITUTE.

Monthly Meeting.

THE stated monthly meeting of the Institute was held at their Hall on Thursday evening, April 22, 1830.

ISAAC HAYS, M. D., was appointed chairman, and

WILLIAM HAMILTON, was appointed secretary pro tem.

The minutes of the last meeting were read and approved.

Mr. S. P. Morris presented to the Institute, *The British Architect*, or the *Builder's Treasury of Stair-cases*, and also

A German work on Architecture, by Jacob Van Campen, *Architect*, 1661.

The corresponding secretary laid on the table the following works received in exchange for the Journal of the Institute, viz.

London Journal of Arts and Sciences, for February and March, 1830.

The Mechanic's Magazine, for July, August, September and October, 1829, and January and February, 1830.

The Quarterly Review, Nos. 10, 11, and 12, new series.

The Journal of Arts and Register of Patent Inventions, for August, September, October, November, and December, 1829, and January, February, and March, 1830.

Gill's Technological and Microscopic Repository, for February and March, 1830.

Recueil Industriel, for October and November, 1829.

The North American Review, for April, 1830.

The death of Dr. Godman was announced, whereupon, on motion, it was unanimously

Resolved, that the Institute have heard with extreme regret of the death of their former professor of Natural History, John D. Godman, M. D.

Resolved, that the Institute entertain the highest esteem for the talents, attainments, and character, of Dr. Godman.

Resolved, that the corresponding secretary be instructed to transmit to his family a copy of the foregoing resolutions, and to express to them the sympathy of the Institute for the loss which they have sustained.

Resolved, that the above resolutions be published in the Journal of the Institute, and in the daily papers.

Mr. Charles Potts submitted a paper on "Communicating Heat by Steam," which was read, and on motion, referred to the committee on publications.

ISAAC HAYS, *Chairman.*

WILLIAM HAMILTON, *Recording Secretary, pro tem.*

TO THE FRANKLIN INSTITUTE.

On communicating Heat by Steam; in reply to a query upon that subject in the number of this Journal for March last.

A correspondent in your Journal for March, (p. 216,) under the signature of "Enquirer," proposes a query respecting the heating of water by steam and the solar ray, which, if we mistake not, its purport may be otherwise expressed, as follows.

If by means of steam, the temperature of a given quantity of water is raised from 59° to 120° of Fahrenheit, how high would the same steam have raised the temperature of the water, supposing it to have been heated previously (by the solar ray or otherwise) to 110° of Fahrenheit.

The application of steam for communicating heat to water being extensively used, as in steam engines, brew, wash, and bath houses, dying vats, &c. we hope to be indulged if, in the following solution of the above question, we chance to make a few digressions.

It is known that a quantity of water raised to the boiling point (212°) requires as much heat to convert it into steam as would have raised the temperature of the water, if its volume remained unchanged, at least 900 degrees higher.

The amount of caloric, therefore, in steam of the same temperature with boiling water, is $212^{\circ} + 900^{\circ} = 1112^{\circ}$.

Hence it follows, if a cubic foot of steam at 212° (which is very nearly the product of a cubic inch of water) be compressed into the space of *one cubic inch*, no heat being allowed to escape, its temperature would be increased to 1112° .

Hence also, an equal weight of steam, or water, will impart the same heat, when the temperature of the latter is supposed to be elevated 900° above the former.

In this view of the subject, therefore, we are enabled to reason, from principles relating to the communication of heat between homogeneous bodies.

Let H = the heat required to convert water into steam, or 900° .
 h = the temperature of the steam.

S = the weight of steam.

W = the weight of water to be heated.

T = its temperature.

t = the temperature to which it is required to be heated.

As two bodies of the same kind differing only in magnitude and temperature, when brought into contact acquire a common temperature, it must be obvious that when the steam S , has heated the water W , to the temperature t , the quantity of heat which it has lost, or rather imparted to the water, will be indicated by $H + h - t$. For $H + h$, expresses the heat of the steam as it came from the boiler, and t the temperature to which it is reduced after the mixture.

Again, the temperature of the water W , before the steam was admitted into it being T , and after the admission t , the increase of its temperature will be denoted by $t - T$.

Hence we have obviously the following analogy, $H + h - t : t - T :: W : S$, and consequently, $S = \frac{t - T}{H + h - t} W$. This formula which serves to find the quantity of steam necessary to heat a given quantity of water, to a given temperature, expressed in words, will stand as follows.

Multiply the quantity of water to be heated, by the difference of temperature which is to be given to it, and divide the product by the difference between the measure of caloric in the steam, and the temperature it gives to the water.

In illustration of this *rule*, we shall apply it to determine the conditions of the first experiment.

Per query. What quantity of steam, at 212° , will suffice to raise the temperature of 900 cubic feet of water, from 59° to 120° Fah.

Here we have the quantity of water $W = 900$ cubic feet. Its temperature $T = 59^\circ$, and the temperature to which it is raised $t = 120^\circ$.

Again, the temperature of the steam $h = 212^\circ$. Its measure of caloric will be $H + h = 900^\circ + 212^\circ = 1112^\circ$. Hence by the *rule* we have the quantity of steam S , equal to $\frac{120^\circ - 59^\circ \times 900^\circ}{1112^\circ - 120^\circ} = 55\frac{1}{2}$ cubic feet of water converted into steam.

The quantity of water necessary to form the steam, it may be observed, will always be of the same name with the water to be heated.

From the foregoing general rule, may be derived the following formulas.

1. To find the quantity of water of a given temperature that will be required to make any given reduction in the temperature of steam, we have, $W = \frac{H + h - t}{t - T} S$.

Example. How much water, at 60° , will be required to condense one cubic foot of steam at 212° ?

Here the amount of water in the steam $S = 1$ cubic inch its temperature, $h = 212^\circ$, also when condensed $t = 212^\circ$. The tempera-

ture of the water, $T = 60^\circ$. Hence the amount of water $W = \frac{900^\circ + 212^\circ - 212^\circ}{212^\circ - 60^\circ} = \frac{900}{152} = 5.9$ cubic inches.

2. To find as above, the temperature, when the quantity of water is given, $T = \frac{(H + h - t) S}{W} - t$.

3. The quantities of steam and water being given, to find the temperature of the steam necessary to raise water from one given temperature to another, we have $h = \frac{(t - T) \times W}{S} - H + t$.

Example. What must be the temperature of one cubic foot of steam, to raise one cubic foot of water from 60° to the boiling point (212°).

Here the quantity of water $W = 1$ cubic foot, or 1728 cubic inches. The quantity of water formed into steam $S = 1$ cubic inch, temperature of the water to be heated $T = 60^\circ$, the temperature to be given to it $t = 212^\circ$. Hence we must have the temperature of the steam, h , equal to $(212^\circ - 60^\circ) \times 1728 - 900^\circ + 212^\circ = 261544^\circ$, which is nearly ten times greater than the temperature of melted iron.

4. When the quantities of water and steam are given with their respective temperatures, to find the temperature resulting from their mixture, we have $t = \frac{(H + h) S + TW}{S + W}$. Or in words, add together the products of the weight of steam by its measure of caloric,

and the weight of water by its temperature, and divide by the sum of the weights of water and steam mixed, the quotient will be the temperature required.

Example per query. A vat containing 900 cubic feet of water at 100° , has an equal quantity of steam mixed with it, which in another case raised the temperature of an equal amount of water from 59° to 120° . What will be its effect in this instance?

It has already been shown that $55\frac{1}{3}$ cubic feet of water formed into steam, at 212° , will be required to raise 900 cubic feet of water from 59° to 120° . Hence, the temperature of the steam being the same for the present example, we have the weight of steam $= 55\frac{1}{3}$ cubic feet of water, its measure of caloric $= 900^\circ + 212^\circ = 1112^\circ$. The weight of water $= 900$ cubic feet, and its temperature 110° , then by the rule, $\frac{1112^\circ \times 55\frac{1}{3} + 110^\circ \times 900}{55\frac{1}{3} + 900} = 168^\circ$ the temperature of the water in the sun's vat after mixture.

When water is employed for communicating heat, before it has received the elastic form, we may compute its effect in either of the preceding cases, by striking out of the formula the term H .

5. The heat required to convert water into steam, or to give to mercury, ether, &c. their elastic form, may readily be determined by the formula $H = \frac{(t - T) \times W}{S} - h + t$. When the weights of the liquid and gaseous masses W and S , their respective tempera-

tures T and h , and the temperature t , resulting from their mixture, are known.

With respect, yours, &c.

CHARLES POTTS.

Philadelphia, April 2, 1830.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Notice of some errors in Mr. C. POTTS' paper on Computing the Power of Steam Engines.

SIR,—In the February number of your Journal, it is stated, by Mr. Potts, that the velocity with which steam, at the temperature of 212° , will rush into a vacuum, is 644 feet per second. Now I find by taking Mr. Potts' estimate of the specific gravity of steam, which I believe to be correct, or nearly so, from the best experiments—that an atmosphere of steam of uniform density must be 64500 feet high to equal a pressure of 30 inches of mercury, and by the laws of falling bodies it may easily be calculated that a body having fallen 64500 feet, will have acquired a velocity of 2000 feet, (in round numbers,) which is the velocity with which steam would rush into a vacuum. 2000 being substituted for 644 in Mr. Potts' calculation, will increase his maximum velocities more than 3 to 1.*

Mr. Potts says, further, "it is established in dynamics, that when the velocity with which any engine works is *one-third* of the *greatest velocity* with which it is capable of working, then will the work done be a *maximum*." This again is incorrect; for though this doctrine is laid down in some of the older books, the fallacy has been pointed out by later writers, and an unexceptionable demonstration given that the maximum velocity is when the machine moves with one-half of the velocity of the impelling force, and not one-third, as assumed by Mr. Potts. [See Edinburgh Encyclopedia, article Mechanics, and 3d vol. of the Transactions of the American Philosophical Society, article by Mr. Waring, also Smeaton, whose experiments demonstrate the same principle.]

If then these principles are applicable at all to steam, Mr. Potts' maximum velocity must be again increased in the ratio of one-half to one-third; and by calculating his maxima with these corrections, it will be found that the piston must move a little more than four and a half times as fast as he has made it. For instance, in the last case calculated by him, instead of 11 feet per second, his piston would have to move with the velocity of 51 feet.

But these principles do not apply to overshot wheels, nor steam

* Since writing the above, I have read a work on Rail-roads, by Thomas Earle, Esq. of this city, just published, which I would recommend to the readers of the Journal, as containing a great deal of information in little space. I perceive the author gives the specific gravity of steam a little greater than Mr. Potts. I have not authorities in my reach at this moment to decide which is right, but in either case the velocity of steam rushing into a vacuum will be more than double what is allowed by Mr. Potts.

engines where the power is caused, not by impulse, but by pressure. In water power it is applicable only to undershot wheels, for in overshot wheels it is equally consonant with theory and experiment, that the slower the motion the better, provided it is equable and uniform. And the same is true of steam engines, though in these last an increase of velocity even to the extent of 20 feet per second would not diminish the power more than one-hundredth of the whole, if the communication between the boiler and the cylinder is as large as it should be. And even where this communication is too small, the loss of power will not be occasioned by the piston's running away from the steam, as Mr. Potts supposes, (for the steam easily keeps up with the piston; even when the communication is stopped;) but by the increased density of the steam near the end of the stroke, as was very clearly shown by "An Old Engineer," in a subsequent number of this Journal.

In Mr. Potts' concluding remarks on this subject, he calculates that if the piston of an engine runs at one time with a velocity of 660 feet per minute, and at another with a velocity of 200 feet, and the piston in the former case has a pressure of 100 lbs. to the inch, and in the latter, of 133 lbs. to the inch; that the effect in the former case will be to the effect in the latter as 66000 is to 26600. This calculation is perfectly just. But Mr. Potts would have us to believe that there is a great loss of power in the latter case, by not attending to the "adjustment of the load," or in other words, his reasoning implies that the same quantity of steam was used in both cases. But this is not the fact: and Mr. Potts will find, by reviewing the subject, that the quantities of steam used in the two cases were in proportion to the work done, or rather there was a slight balance in favour of the slow motion, for it is known that the tension of steam increases in a higher ratio than the density, (which is due to the increase of temperature, 480 degrees giving one atmosphere.) Besides, every person at all conversant with the subject, knows that the higher the temperature at which the steam is used, the sooner it may be cut off, and thus a greater effect obtained by a given quantity of steam. For example, by using steam dense enough to allow its being cut off at one-third of the stroke, just double the power would be obtained by the same quantity of fuel, which would be obtained by using the steam at half the density without cutting it off at all. For the mean density of the steam after it is cut off is one-half, and it operates through twice the space, and a $\frac{1}{2} \times 2 = 1 \times 1$.

As to a loss of power involved in the "crank motion," I entirely agree with what was said by an "Old Engineer" in reply to Mr. Potts.

J. P. ESPY.

On the Explosions of Boilers of Steam Engines. By M. ARAGO.

[From the *Annuaire du Bureau des Longitudes*, 1830.]

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

THE steam engine may be considered as the noblest work of human ingenuity when we shall have succeeded either in preventing

the explosions to which it is liable, or the destruction of property and of human life, which are too frequently the consequence of such accidents. This problem, it must be confessed, has not yet been solved completely, although it has occupied the attention of men skilled in both science and the arts. The ingenious contrivance of Papin, known under the name of the *safety valve*,* is sufficient, it is true, in *common cases*, but there are circumstances, happily not common, in which these valves do not answer the purpose for which they are applied, and are even dangerous. The object of this paper is to point out these circumstances as far as the imperfect state of our knowledge will permit, the causes which lead to them, and the more or less effectual means of avoiding them.

I shall at first set before the reader a brief account of all the explosions which are known to me, and which have been witnessed or described by experienced engineers. In this way we shall be able to examine to advantage the different explanations which have been given of these dreadful accidents.

Examples of the most violent explosions which have taken place up to this time.

At a large distillery, called *Lochrin*, near Edinburgh, the proprietor, with a view to economy, undertook some years since to substitute steam distillation in place of the old mode. Large metallic tubes, through which steam circulated, were made to pass and repass through the vessels containing the liquids to be distilled. The steam was generated in a boiler of forged iron of more than a third of an inch in thickness, 37 feet in length, three feet in width at the bottom, and two feet at the spring of the top, and four feet in height. The weight of this boiler was 18 tons. On the top of this boiler were two safety valves so arranged as to open when the pressure of the steam within the boiler should exceed four atmospheres, or 60 lbs. to the square inch. To guard against any addition of weight by the workmen, one of these valves was inclosed in a grating fastened by a lock.

This immense apparatus was put in operation on the 21st of March, 1814. Twelve days from this time it no longer existed, the whole had been destroyed by an explosion.

In bursting, the boiler was divided into two distinct and unequal parts. The upper portion composed of the cover and the two sides, weighed 14 tons. It was thrown upwards with such force that after penetrating a brick arch and the roofing of the building, it rose to the height of 70 feet. This enormous mass fell at a distance of 150 feet from its former bed, upon one of the buildings of the distillery, passed through it and crushed a large trough of cast iron situated upon the ground floor of the building. Happily but two of the workmen were near the boiler when it burst. These were the only persons killed, although other workmen were in the adjoining buildings,

* This valve, the common safety valve, is described in a subsequent part of this paper.—TRANS.

and the boiler, like the crater of a huge mine, threw in every direction, and with prodigious violence, quantities of tools and fragments. The limbs of one of the workmen killed were separated from the body; it is a remarkable fact that the limbs remained in the distillery while the body was found at a distance out of the building, amidst the fragments.

The line along which the boiler was torn was perfectly horizontal, and followed a row of nails as regularly as if the iron had been cut with strong shears.

The boiler, on the plan of those of Watt, was *convex to the interior*, on the side next the fire, in this way it formed a sort of arch which allowed the flame from the furnace to play in the centre, almost, of the liquid. After the explosion, this side was found to be *convex outwards*, so strong had been the pressure from within. This change of form might have been predicted, but if the examination made after the accident had not proved it, it would have been difficult to believe that the bottom of the boiler of 4 tons in weight, and which bore such evident marks of the enormous *downward* pressure to which it had been subjected, would be *raised* to a height of 14 or 15 feet, and carried to some distance from the mass of masonry upon which it had been placed.

It is important to remark, that no circumstance authorizes the supposition that the accident at Lochrin depended upon the imperfect construction of the safety valves. I have already said that one of them was under lock, so that we cannot suppose an overcharge of the valve.

Second example, characterized by the simultaneous explosion of several boilers.

The steam boat *Rhone*, constructed by Messrs. Aikin and Steel, was intended to ply as a tow-boat between Arles and Lyons. It carried a very large engine, well made at Paris, in the works of la Gare, and fed by four boilers of laminated iron each 52 inches in diameter. Since the accident, it has been found that the metal of the boiler was, in many places, not more than $\frac{1}{4}$ of an inch in thickness.

On the 4th of March, 1827, while preparing for a trial which was to be witnessed by the authorities of Lyons, the boilers burst. Several persons, Mr. Steel among others, were victims of this accident. Some of the spectators on the wharf were killed by splinters from the boat. The whole deck was thrown to a great distance, the braces and the pipes of the chimneys, weighing more than 3 tons, were projected almost vertically to a considerable height; the top of one of the boilers fell 330 yards from the boat; it did not weigh less than 2 tons.

This horrible catastrophe was the inevitable consequence of the imprudence of the engineer. Disappointed in not being able to stem the current with as great rapidity as he had expected, Mr. Steel fastened down the safety valves of the four boilers. This fact, however incredible it may seem, has been proved to be true. We have remarked that there were four boilers in the boat. It is certain that

two of them burst almost at the same instant. If I have been correctly informed, in drawing up from the river a third, not long since, it was found that this also had burst. This bursting of two, and perhaps three boilers, at the same moment of time, is a remarkable fact, and one which will be referred to when we shall speak of the different explanations given of the causes of these accidents.

I ought not to forget to mention that at Lyons, as at Lochrin, the top of the boiler, which was thrown to a distance of 330 yards, had separated from the sides along a line nearly horizontal, although along this line the metal varied in thickness more than 8 hundredths of an inch. M. Tabareau, from whom I have copied these interesting details, has calculated that the additional thickness of 8 hundredths of an inch gave to the thickest parts of the metal an additional resistance of more than 6 atmospheres in 20 or 25, which was the total strength of the boiler. Thus there was a rent made at the same instant in parts of the boiler of which the strength differed six atmospheres at least.

I have just remarked, that the fact of the simultaneous explosion of several boilers placed over different furnaces is worthy of attention. It may be useful to cite another example of the same kind.

At the entrance to the tin mine of Polgooth, there is a large steam engine fed by three separate boilers. This machine having been stopped for a few minutes, to give the engineer an opportunity of repairing the air pump, two of the boilers immediately burst. Captain Reed, who was then near the mine, states that the noise of the first explosion had scarcely ceased when the second was heard.

Explosions caused by overloading the safety valve.

After the explosion which entirely destroyed the sugar refinery in Wellclose Square, London, it was found that the casting of which the boiler was made was not every where of a proper thickness. At the bottom the boiler was not less than $2\frac{1}{2}$ inches thick, on the two vertical faces an inch and a half, in the lower part of the cover seven sixteenths of an inch only, in some other points not more than the eighth of an inch thick.

Some minutes before the accident, an agent of the constructor, disappointed at the want of power of the apparatus, notwithstanding the representations of the workmen of the refinery, had loaded the safety valve with an enormous weight, at the same time urging the fire as much as possible.

We may remark that at London, as well as at Lyons, the boiler burst in places which were so unequal in thickness, that if we represent by unity the force which would burst the thinnest parts, the thickest would resist a tenfold action.

During the inquiry instituted by the house of commons in 1817, into the circumstances of the bursting of a steam boat boiler at Norwich, Mr. William Chapman, a civil engineer of Newcastle, mentioned the bursting of a boiler caused, as in the preceding case, by an overcharge of the safety valve; a workman had seated himself upon the lever of the valve to exhibit to his comrades the see-saw

motion which, he said, would take place as soon as the steam became strong enough to raise him. The valve was not raised, but the boiler burst. The fragments killed and wounded a number of persons.

In America the boiler of a steam boat on the Ohio burst while the crew were getting the boat under weigh, that is to say, when the machinery, not being in motion, no steam was consumed, the fire being raised in the furnace. To prevent accident, the safety valve should have been raised or the weight removed from it; through a strange mistake, the engineer had placed upon it an additional weight.

Explosions preceded by a great decrease in the tension of the steam.

In every case hitherto cited, except that of Lochrin, it has been proved that the safety valve was either completely shut, or loaded too heavily. The causes of these accidents seem evident. We are now about to enter into a detail of facts much less simple. Several of them, it must be confessed, seem at first paradoxical, and inspire doubt, but the examples are numerous, and the authorities on which they rest undoubted. Some minutes before the cast iron boiler of a low pressure engine in the factory of M. Feray, at Essones, burst, on the 8th of February, 1823, the engine supplied by it moved more slowly than usual, so much so that the workmen complained of it. Just before the explosion, the two safety valves had opened and the steam was issuing through them freely.

An accident in every respect similar to that of Essone, took place some days afterwards, on the boulevard of Mount Parnassus, Paris. Here, as at the factory of M. Feray, the workmen complained that the slow rate of the engine would enable them to accomplish but little work during the day, when suddenly the boiler, which was supposed to be nearly void of steam, burst. This boiler was of rolled copper. Nothing induced the suspicion that the safety valve was not in good condition, on the contrary, there is every reason to suppose that a free escape of steam preceded the explosion.

When the boiler of the steam boat Etna (America) burst, the piston was making but eighteen strokes in a minute. Usually the number of strokes was twenty to the minute, thus the boiler burst under the pressure of a vapour sensibly less elastic than that which it usually contained.

On the day of the explosion in the steam boat Rapid, at Rochefort, the gauge had often indicated that the steam in the boiler would support 12 inches of mercury more than the atmospheric pressure; some minutes before the accident the gauge was at the height of only 6 inches.

The inquiry in relation to the explosion on board the steam boat Graham, showed that just before the accident, a weight of twenty pounds had been taken from the safety valve.

Explosions immediately preceded by the opening of the safety valve.

I will first observe that the bursting of the boiler at Essone might

have been placed under this head, for the safety valve opened just before the explosion.

A low pressure boiler in a workshop at Lyons, burst immediately after a large aperture had been opened, by turning a cock, through which the steam began to issue with rapidity. To open this aperture was equivalent to raising the safety valve: here then an explosion was attendant on the very means which would seem most proper to prevent such an accident.

This fact, however strange it may appear, will be received without scruple, when I state that it is given by M. Gensoul, of Lyons, and further, that this skilful engineer witnessed the circumstance.

If, in an extreme case, the opening of a safety valve may occasion the bursting of a boiler, it must frequently happen that though no such effect should be produced by opening it, yet there may be produced a sensible and sudden increase in the elasticity of the steam; the action can within such limits be observed without danger. Such an experiment was made at Lyons upon a small high pressure boiler, and as soon as a large aperture for the escape of steam was made, by turning a cock, the safety valve was forced open. A contrary effect was observed by M. Dulong and me at Paris, we always found a diminution in the tension of the steam caused by opening a valve; the experiment at Lyons is not the less certain, however, since it rests upon the authority of M. Sabareau, director of the school of la Martiniere, and of M. Rey, professor of chemistry. The probable causes of this disagreement which I shall explain hereafter, will show how the particular kind of accidents recorded in this article may be prevented.

Rending of boilers by a pressure from without.

Boilers constructed of plates of laminated copper or iron, low pressure boilers particularly, are subject under certain circumstances to accidents exactly the inverse of those which we have been engaged in describing.

These boilers are sometimes completely crushed, the sides bending to the pressure from without. Lyons and St. Etienne have been the theatres of several accidents of this kind, which should be guarded against if it were only to prevent whole factories from being reduced suddenly to a state of inaction.

The inner cylinders of boilers having the furnace and flues within, give way occasionally. They are unable sometimes to resist the pressure of the steam in the annular space around them, lose their shape, becoming flattened: this change of figure cannot take place without the metal giving way, and hot water thus escaping into adjacent rooms, produces dreadful havoc. I shall quote an example of this sort from Mr. John Taylor, fellow of the Royal Society, London.

At the Mold Mines, in Flintshire, there is a large steam engine supplied by three boilers with interior flues. The machine was once stopped for five minutes; the engineer had raised the doors of the three furnaces and closed the registers in two of the flues; just as he closed the register of the third flue, he saw a burst of flame from

the furnace into the room, and an explosion immediately followed. Two workmen who were in the direction in which the boiling water escaped, were killed instantly. A careful examination of the boiler showed that the exterior cylinder had not moved, nor had it suffered the slightest injury. The weight attached to the safety valve was also in its place after the accident. The interior cylinder had not moved from its place, as it sometimes does in this sort of explosion, but it was so flattened throughout the greater part of its length by the yielding of the lateral faces, that there was scarcely room to introduce the hand between them.

It may appear at first sight strange that I have placed an explosion proceeding from the too great elasticity of the steam within the boiler, in the same class with the inverse accidents described in the preceding paragraph, but it will be seen that these two effects have, to all appearance, a common cause.

Accidents peculiar to boilers with interior flues. }

However little we may have studied the many causes of the explosions of steam boilers, and the varied combinations of them which are possible, we must have seen that to attempt to reduce them to fixed rules, would be out of the question. We may remark, however, that the form of the boiler is a prevailing cause, and determines the nature of the fracture. In this point of view, particularly, detailed and complete tables of the accidents of daily occurrence would be very useful. It appears from the tables published about two years since, by Mr. John Taylor, that in boilers of concentric cylinders, or with interior flues, the faces of the interior cylinder are the weak parts. After the almost simultaneous explosion of the two boilers at the Polgooth tin mine, the interior cylinders of both boilers were found to have been twisted and rent in many places.

At the East-Crennis mine the interior cylinder was not only flattened by the crushing together of the upper and lower faces, but the cylinder was thrown with great force out of the building without the exterior cylinder having been moved, or having been badly rent. The preceding article contained a more striking example of the change of figure and rending of the interior flue* without injury to the exterior cylinder of the boiler.

Explosion preceded by the boiler becoming too highly heated.

Too high a heat communicated to that part of the boiler which contains the steam may give rise to accidents. An example of this may be taken from an explosion which occurred at a foundry in Pittsburgh, America.

* Popularly termed "the collapsing of the main flue." Such accidents are not uncommon in the high pressure boilers of the boats upon our western waters, usually of this construction. In the late accident on the Hudson, the interior flue gave way, allowing the boiling water to be pressed against the false front of the boiler, which was incapable of resisting violence.—TRANS.

In this establishment a high pressure engine of eighty horse power was supplied by three separate cylindrical boilers, each being 30 inches in diameter, and 18 feet in length. It had been observed for some time, that owing to a defect in the pipe from the pump which supplied the boilers with water, one of them did not receive a sufficient supply, and became red hot, but as the two others furnished enough steam, they thought that it was unnecessary to repair the feeding pipe. This boiler receiving an insufficient supply of water, burst, the greater portion separated from one of the ends was projected under an angle of 45° , burst through the roof of the building, and fell about 600 feet from it.

Explosion of a boiler in the air.

We have rarely precise details of the circumstances accompanying the bursting of a boiler, either because the accidents have happened unexpectedly, and scarcely last some tenths of a second, or that those who have witnessed them have been victims to the accident. An attentive examination of local circumstances, of the mass remaining, of the fragments thrown from it, their distances, &c. will often serve to show what part of the boiler yielded first, and with what velocity the fragments have been thrown: usually our information stops here. It is of all importance then, to collect carefully every thing which chance may throw in our way in relation to accidents so dangerous and so worthy of study. I therefore hasten to extract from a letter of Mr. Perkins, the following facts, which will not appear devoid of interest.

An explosion came to my knowledge, says this skilful engineer, which was preceded by a rent through which the steam escaped with great velocity. Notwithstanding this unexpected safety valve, the boiler was separated from the masonry upon which it was placed, was projected entire to some feet above the ground, and in the air the explosion took place which burst it in two. The upper half rose very high, the lower fell to the ground with great noise.

I am much mistaken if the same circumstances did not attend the Lochrin explosion.

It remains for us to ascertain from the preceding facts what the different causes are which have produced so many accidents, and the means of preventing their recurrence.

Necessity of providing safety valves: safety valve of Papin, its defects, accidents which such valves may prevent.

Florence Rivault, Solomon de Caus, and the Marquis of Worcester, had already remarked in 1605, 1615, and 1663, (as may be seen in our first article, *Annuaire* for 1829,) that a vessel, however strong its sides might be, containing water, if placed over a fire, would burst unless an opening was provided for the escape of the steam as fast as produced. The fatal experiment of Mr. Steel at Lyons, has too certainly shown the truth of this opinion. The temperature which will cause the rending of a vessel must depend upon its form

and dimensions, and upon the tenacity and thickness of the material of which it is made. If we were sure that the heat of our furnaces could be kept below a certain limit determined beforehand, no further precaution would be necessary than to effect this; but after observing, even but for once, the manner of supplying an ordinary furnace with fuel, how much the combustion depends not only upon the nature of the fuel, upon its size, upon the manner of placing it upon the grate, not to speak of the influence of the state of the atmosphere, we should immediately resign the idea of deriving from the furnace means of preventing explosions.

We must then begin by supposing that a boiler entirely closed, and not of an enormous thickness, (there being more than one difficulty to be overcome before we can exceed certain limits in this particular) may contain, at times, steam of an elasticity greater than can be borne by the resistance of the faces. But to prevent this from happening is the only mode of preventing an explosion.

The safety valve invented by Papin seems to cut short all difficulty.

This safety valve consists of a hole, say of an inch square, made in the upper part of the boiler, upon which is placed a metal plate loaded with a certain weight. It is evident that the hole will remain closed as long as the pressure of the steam within the boiler is less than the weight of the valve, together with that of the atmosphere, upon the square inch, and that as soon as the pressure within shall exceed this, the valve will be raised and will give a free vent to the steam.

Let us now endeavour to ascertain how it may happen that so simple, so apparently reasonable a means, and one so easily executed, may not prove always efficacious.

The plate forming the valve rises the instant the weight with which it is loaded is exceeded by the pressure of the steam within the boiler, but to prevent any increase of elasticity in the steam within, this valve must further be of sufficient size to give vent to all the surplus steam. The escape of steam depends upon the diameter of the opening, and an opening which may be sufficient for ordinary occasions, may be much too small when accident causes the sudden conversion of a great quantity of water into steam. In such a case the valve may diminish the evil, but cannot prevent it. If the difficulties of adjustment, and the enormous weights, required did not set limits to the size of the opening, there would be a great advantage in using safety valves of very large openings. Without going too far, we may, I think, admit that hitherto we have used valves of too small a size. The justness of this assertion will not be doubted, especially if we recollect the curious observations recently made upon the flow of fluids through small apertures. It has been found that a light disk brought perpendicularly opposite to a current of steam flowing from an aperture made in a high pressure boiler, is not always repelled. At a short distance from the opening, the plate, which is urged by two opposite forces, the steam which tends to drive it from the aperture, and the pressure of the atmosphere acting towards it, remains, in consequence of the equilibrium of these two

forces, suspended without motion. I cannot here examine how it happens that the steam loses in the very act of issuing, so great a part of its strength, that the pressure of the atmosphere counterbalances the remainder; I shall content myself with stating the fact that the plate is removed but a short distance from the aperture; the same thing will happen with the disk of the safety valve, and thus when it is raised, much less steam will issue than was calculated by assuming the vent to be of the size of the aperture closed by the valve.

M. Clement, who has studied these facts with great care, saw in them grounds for condemning the safety valve with a moveable disk. This opinion goes perhaps too far, but it is certain that the partial rise of the valve offers an additional difficulty to be obviated by machineists, and the imperfect construction of the valve may sometimes be one among the causes of explosion.

Let us pass to difficulties of another kind.

In France the law requires that every cast iron boiler before it can be used must have borne an interior pressure of five times the amount of the pressure under which it is to be used, and this pressure is reduced from five times to three times for boilers of rolled or hammered iron. These limits seem great, and often excite complaints on the part of machineists; we shall see, however, that they are far from affording entire security.

The boilers are proved at ordinary temperatures, at which the metals have a greater tenacity than when heated. As they approach a white heat, the diminution in tenacity is enormous. The experiments of M. Tremery, for example, have proved that the tenacity of forged iron at a dull red heat is but one-sixth part of that of the same metal when cold. If then, by mishap, any part of the boiler should become red hot, the metal would be near the point of rupture, *without the safety valve being raised*, although from experiments made upon the boiler when cold, we should have a right to believe it far from that point.

But why, it may be said, not make a decisive experiment? why not place the boiler exactly in the circumstances under which it is to be used; why, in a word, not substitute steam for water in proving it? The answer is, that by the aid of a pump the boiler may be proved any where, even in the workshop of the person who made it, with but little apparatus, and at a slight cost; whilst to prove it by steam would, on the contrary, require the building of a furnace for every boiler, and a large place for the purpose; we paralyze the arts when we surround them with such trammels. Add to this that the experimenters using the pump run little or no danger even when the boiler gives way, but that this would not be the case were the trial made by steam. The precautions which it would be necessary to take in this latter case to secure the experimenters from danger would add much to the difficulty and expense of this preparatory trial. It seems then that the trial by the pressure of water, notwithstanding the defects which I have already mentioned, and those which yet remain to be explained, will continue to be used.

When we act upon the faces of a boiler by a forcing pump, the interior pressure is increased very gradually: this trial gives us no information in relation to the resistance of these faces to a considerable pressure suddenly applied, but to these abrupt changes of pressure it may be exposed in practice.

Further we may remark, that these trials made upon a new boiler show what it can bear when new, not what it will be able to sustain after some weeks or some months use, after inequalities of temperature have strained the metal in every direction, and disunited its fibres, after rust has acted upon it, &c. &c.

To recapitulate, we have found that notwithstanding the proper construction and good condition of a safety valve, a boiler may explode: 1st. Because the opening of the safety valve is not sufficient to give vent to the steam which is generated suddenly, and in great quantity.

2nd. Because the boiler has been proved when cold, and when heated, particularly when it reaches a high temperature, the tenacity of the metal is much lessened.

3d. Because an *abrupt* increase of pressure may occasion rupture in cases where a greater pressure produced gradually had been attended by no evil consequences.

4th. Lastly, because the boiler is injured by exposure to the fire, and after a few months the tenacity of the metal composing it is often much diminished.

A safety valve, however well constructed, can never warrant the engineer in neglecting to prove his boiler from time to time, nor can it warrant him in not endeavouring to prevent by all the means in his power abrupt changes in the elasticity of the steam, and in not preventing the boiler from, at any time, being too strongly heated.

I have supposed, hitherto, the safety valve in good order; in fact it would seem, at first, difficult for so simple a contrivance to get out of order; but when we consider that the moveable disk often rusts, and that it acquires in consequence of this action, particularly when at rest, a strong adhesion to the metal upon which it rests, we can see that it may not move under pressures much above those fixed upon to be attended with the escape of steam. Mr. Maudslay, whose skill and experience are well known, said that a safety valve no longer deserved its name when it had been left without being moved for a week; he placed near some of his boilers a cord within reach of the fireman, by which he could raise the safety valve from time to time. It has been contrived to produce such a motion by means of levers worked by the machinery, but when the boiler is not near to the working parts of the engine this is not practicable.

The firemen are generally ordinary labourers without prudence, who too often overload the safety valves either to quicken the working of the engine, or to make a parade of their courage. This danger may be avoided, perhaps the greatest danger which is to be feared, by having always two safety valves to every boiler, the one under the control of the fireman to be used whenever the steam is to be let off, the other to be inclosed by a grated box, of which the

engineer, or the proprietor of the engine, should have the key. The use of two safety valves was recommended almost unanimously by a number of engineers examined before a committee of the house of commons in 1817; in France, a royal ordinance makes this precaution absolutely essential. Perhaps it would be well to require that each boiler should be provided with some simple contrivance conveniently placed, by which the fireman could ascertain from time to time that the disk of the valve moved freely: those who are used to visiting workshops know that workmen are with difficulty induced to perform those operations which leave no mark of their performance, unless they can be done easily.

Plates of fusible metal.

As soon as it was found that the common safety valve sometimes got out of order and did not present a certainty of security, it was proposed to replace them by an entirely different contrivance, the action of which should never be uncertain. This was the fusible metal valve, already described in the *Annuaire* for 1829.

To understand rightly the use of these valves, we should know that it is possible that steam should have a very high temperature and but little elasticity, but not possible that a great degree of elasticity should not be accompanied by a high temperature.

Experimenters have determined the lowest temperature necessary for steam to acquire a tension of one, two, three, ten, &c. atmospheres. By using these results we can know what temperature the steam must not surpass after we have fixed upon the pressure. If we then cover an opening in the boiler with a plate made of an alloy of lead, tin, and bismuth, in proportions such that the alloy will melt at the limit of temperature fixed upon beforehand, this temperature can never be exceeded, for on reaching it the plate melts and gives vent to the steam.

In France a royal ordinance requires that every boiler shall be provided with two fusible plates of unequal sizes. The fusing point of the smaller is 10° (18° Fah.) above the temperature of steam having an elasticity equal to that which the steam to be used in the engine should have. The second plate fuses at 10° (18° Fah.) above the first.

Although many cases may be cited in which fusible plates have probably prevented explosions, they are employed unwillingly by most, preference being given to the common valves, with which, in addition to the plates, the boilers must be provided. Let us then examine the objections to these plates.

It was said at first that since these plates were affected by temperature, and not by pressure, they might melt when the steam within was very hot, but not elastic in proportion, but this can only happen when the vapour is not saturated with moisture, that is, only when there is not a sufficient supply of water within the boiler, then a portion of the boiler must become heated, perhaps even to redness, and then there is imminent danger of an explosion; this first objection seems, therefore, to be refuted.

The plate does not approach the point of fusion without being softened, it is therefore to be feared that it may give way under a tension much less than that which would produce its fusion. At the outset this actually did take place, but the difficulty has been obviated by covering the plate with a wire gauze, with small meshes, before it is fixed by bolts to the aperture which it is to close. Even now parts of the plate yield partially, swelling out in different places as the fusing point approaches, but experience has shown that it is only very near to this point that the metal yields entirely, opening a free passage to the steam.

When the fusible plate has been melted, all the steam escapes through the opening which it closed. It may take some time to replace it, to fill anew the boiler, and to heat the water, and during this time the engine stands still. In a steam boat, in certain cases, this sudden absence of the moving power might occasion serious accidents. This is a real and a great difficulty, and perhaps is the reason why our neighbours have not adopted the fusible metal valve, but give preference to the ordinary safety valve. These, it is true, never suffer all the steam to escape. If they open, it is only when the elasticity of the steam within has passed a certain limit; as soon as this elasticity has returned within this limit, fixed by the engineer beforehand, they fall, closing the aperture; thus the moving power can never fail entirely.

The advocates of the fusible metal plates considered as one of the highest advantages of these valves the physical impossibility of changing their limit of action, thus placing them beyond the reach of imprudent workmen. It is true that with these plates all overcharge, in the literal meaning of the word, would be useless, but when the firemen wish to urge their fires more than usual, they understand how to prevent the fusion of the plate, by directing a constant stream of cold water upon it, so that in this point of view perhaps we have gained nothing.

Thin plates.

A safety valve is in fact nothing but an artificial weakening of a certain part of the boiler. It has been proposed to weaken the boiler by covering small holes, made for the purpose, with laminated plates of metal, of which the thickness should be calculated so that they should burst under pressures of one, two, three, ten, &c. atmospheres, according as we should have determined not to exceed two, three, four, eleven, &c. atmospheres in the pressure of the steam within the boiler. It is evident that the bursting of so small and so thin a plate would never cause any serious accident.

This mode, however specious it may appear, has rarely been used, either because it is not easy to determine experimentally the thickness of the plate which for a given size of aperture would burst under a given pressure, or because we cannot be certain of having plates identical in strength. The thin plate is more out of the power of the workmen when in place, than the fusible metal valve, it may, it is true, be weakened, but can never be strengthened, and this is the im-

portant point. In this point of view the thin plates are to be preferred to the fusible metal disks, they have an inconvenience common to the latter, namely, that of suffering the escape of all the steam when they have given way.

Gauge valve.

The gauge tube (a syphon tube the shorter leg communicating with the boiler, while the longer open at the end contains a column of mercury) spoken of before (*Annuaire*, 1829,) may be made to perform the office of a safety valve, and it answers the purpose better than either the common valve or the fusible plate. The common valve shows nothing of the pressure within until it rises, the fusible plate shows nothing until it melts. The fireman learns suddenly that he has reached the limit which he must not go beyond, but he was not warned of his approach to it. The gauge, on the contrary, gives him every moment the measure of the elasticity of the steam; it indicates low as well as high pressures.

The disk of the common safety valve may have lost its power of moving without the fact being known, whilst, on the contrary, if impurities should stop the gauge tube, the want of motion in the mercury would show it immediately: it is plain that in so large an apparatus as a boiler, and from which the steam does not escape constantly, but at short intervals, the elasticity cannot be constant; the boiler and gauge tube communicating, every fluctuation in the steam produces an oscillation in the mercury of the gauge.

The mercurial gauge should then be considered as the best safety valve yet invented, provided its diameter is sufficiently great. Whenever its too great length does not render it inapplicable, it may be considered as a safe-guard in cases where the best constructed common safety valve or the fusible metal plate would have proved a protection against accident. The reader will see the reason for this restriction, when I shall have shown that there are cases in which the opening of the valve may cause an explosion.

Internal, or air valves: their object.

At the time of lighting the fire under a boiler, the space within the boiler, not occupied by water, is filled with atmospheric air. This air, mixed with steam, passes by degrees into the engine fed by the boiler, and at last is completely expelled therefrom. Things being in this state, suppose the working of the machine to be stopped, and the fire suffered to go down, the steam will be gradually condensed as the cooling proceeds, and after some time the space which it once occupied will be almost void. The boiler is then pressed inwards by the pressure of the atmosphere, without there being any interior pressure to counterbalance the action. When the condensation of the steam takes place slowly, it ought not to cause accidents, since the weakest boilers should have been proved under a pressure, directed from within outwards it is true, of not less than five atmospheres. The consequences might be serious, however, if the con-

densation were sudden; for example, if a jet of cold water should play into the steam; then, in an instant of time, the pressure of the atmosphere ceasing to be counterbalanced, would produce the effect of a percussive force upon the whole surface of the boiler, and would crush the boiler in the way already spoken of in relation to the interior flue of certain kinds of boilers. To prevent such accidents, interior valves, called also air valves, were invented. This valve opens inwards. It is kept in its place by a spiral spring within the boiler, the strength of the spring being a little more than equal to the weight of the valve. Or else it is suspended horizontally to the arm of a lever placed on the outside of the boiler, so arranged that the valve exactly touches the interior face of the opening, which it is to close. With this arrangement the elasticity of the steam within the boiler can never become less than that of the atmosphere without the immediate opening of the valve, which will admit air into the boiler, thus when the engine is stopped, having performed its task, there can be no fear that a vacuum will be formed within the boiler. It seems to me that we cannot so safely conclude that the same arrangement would prevent, certainly, the crushing of the boiler, for such accidents result from a great and abrupt diminution of elasticity in the steam. The gradual action of a valve might, to a certain extent, lessen the evil, but could not prevent it. There is but one remedy against such accidents, to watch carefully the means of feeding the boiler, and to prevent the reservoir of steam within the boiler from being suddenly cooled, as would happen, for example, if a quantity of cold water should be thrown upon the exterior. The crushing of the flues within certain boilers would be easily explained if we could prove that sometimes a vacuum is suddenly formed in the smaller cylinder, but as this cylinder does not contain steam, as it forms only the furnace and its flue, we should have had, perhaps, some difficulty in finding how a vacuum could be produced, if the circumstances of the explosion at the Mold mines had not led us to it.

We must recollect that at the time of that accident the door of the furnace was open, while the register of the chimney was closed, that after closing this register a burst of flame issued from the furnace into the room, and the explosion immediately followed.

With the door of the furnace open the combustion could hardly have been active, and the current of air which rose through the chimney could scarcely have been chemically changed. When the register was closed the air no longer flowed in, but that which the chimney already contained remained there shut up. The coal in the furnace was not yet extinguished, the gas which it contained continued to be disengaged, and to mix with the air of the chimney, its proportion soon became sufficient to render the mixture inflammable; it inflamed, escaped in this state through the only vent which remained, namely the door of the furnace, in an instant the small cylinder was, if not entirely void, as the cylinder in Brown's vacuum engine are after a similar inflammation, filled with a gas highly rarified.

I am much mistaken if this explanation, by Mr. John Taylor, does

not give the true key to the frequent crushing of the small cylinders of boilers with interior cylinders. It is important, therefore, when we use that kind of boiler, not to close the register doors until the coal is extinguished. Paltry considerations of economy cannot have weight where there is so evident a danger, and this danger cannot be prevented by interior valves.*

[TO BE CONTINUED.]

Account of the present state of Manufactures in the Netherlands.

[From the Foreign Quarterly Review, for February, 1830.]

WHEN a flourishing agriculture is once established in a country, as is unquestionably the case in the Netherlands, it is commonly a mainspring of prosperity to the manufacturers, who, in their turn, by increasing the size of towns, and the demand for agricultural produce, give an increased activity to the interchange of commodities. Hence, in the natural course of things, manufactures will appear in their proper season without any such interference in the way of protection as most European governments, and latterly the United States of America, have thought fit to bestow upon them. Upon this protecting principle the Netherlands are also acting in a great degree, though the commercial interests of Holland have been the means of infusing into their tariff a much greater portion of liberality than is observable in that of their neighbours. The government displays a very lively sense of the importance of the manufacturing industry, and among other means of furthering it, has adopted that of periodical exhibitions, the first of which took place at Ghent, in 1820, the second at Haarlem, in 1825, and the third will be held at Brussels during the present year (1830.) We have before us the particulars of the articles exhibited at the first two collections, and though they are far from representing the industry of the kingdom as they ought to do, they are nevertheless good guides to the progress the manufacturers are making in the various provinces. A nation like Great Britain, the pillars of whose arch of dominion are made of cotton and hardware, is most closely concerned in the real state of these matters.

The Metallurgic Arts are in considerable activity in the provinces of Liege, Namur, Hainault, and Luxemburg, where there are mines of iron, lead, copper, and coal. The immense establishment of Mr.

* These remarks are applied to a case in which bituminous coal was the fuel. They would apply equally well to all cases in which the fuel yields a combustible gas, as, for example, to pine wood during the first period of its combustion, to rosin, wet charcoal, &c.

An explosion was produced in a common close stove, in this city, by covering a fire of anthracite with wet ashes; on relighting the fire with shavings and charcoal the following morning, an explosion took place in a drum connected with the stove, and placed in the second story of the house, of which the stove occupied the ground floor: part of the drum was thrown with violence against the ceiling of the room.—TRANS.

Cockrill, at Seraing, near Liege, for machinery of all kinds, is one of the most perfect in Europe, and is a striking instance of the wealth that may be acquired by unremitting industry, the original proprietor having left England almost in a state of destitution. The factories and forges of M. Dupont, at Fuyt, near Binche, and at Arquennes, are distinguished for bar iron, made by a high pressure steam engine, for round and sheet iron, and for axletrees and nails. M. Hanonnet-Gendarme, of Couvin, in Namur, is celebrated for the strength and ductility of his iron, which is said to be equal to Swedish. M. Houyoux, of Bousval, M. de Paul-Barchifontaine, of Sobrest. Gery, and M. Silez, of Celestin, in Hainault, work iron in the most superior manner into machinery and implements of all kinds. Articles of steel, copper, and bronze, are executed throughout Hainault and Namur; and as an instance of the tendency of useful inventions to diffuse themselves, the safety lamp of sir Humphrey Davy is now made in the village of Dour, near Charleroi. The cutlery of Arnould-Raymond, and of Laderier, at Namur, is excellent, and prices have been so much reduced that a successful competition with that of Sheffield is confidently anticipated. The hardware of Dupont, François, Simon, Warnaut, and others at Liege, is of the best quality; and the files of M. Raunet, of that city, received a gold medal at the Ghent exhibition, and were pronounced to surpass in quality those of England. It would be fatiguing to enumerate the variety of metallurgic operations going on in the coal provinces, and the multitude of productions, from the smelted iron as it comes from the furnaces, to the needles and bodkins that fill the shops. It is, of course, by this industry that the inhabitants mainly live, and how comfortably they do so in some instances, may be judged of by a visit to the collieries and works of M. de Gorges, at Hornues, near Mons, who has recovered these mines, by draining, from the effects of an inundation—has fixed engines and pumps of 500 horse power—has opened ten fosses—and extracts from them daily 13,000 hectolitres of coal. M. de Gorges employs 2,000 workmen, for whom he has built a handsome town, consisting of 260 neat houses with a garden to each. The rent is from one to two francs per week, according to their size; a very small deduction from the emoluments of men whose wages are from seventy centimes to three francs a day. The streets are laid out with uniformity, and well paved; and in the centre of the village is a large square planted with trees, in which is the ball room for the Sunday amusements, the town hall, and the school of mutual instruction, where 400 children are gratuitously educated. The workmen have the gratuitous use of store houses for all purposes, and of the luxury of baths; and appear altogether in a very happy condition, and comfortable. The benefits which a great capitalist has it in his power to confer, were never more strikingly exemplified than by M. de Gorges's village of Hornues, and we have not thought it inappropriate to mention it specially, because such examples are not only useful, but cheering, amidst the mass of misery with which every nation more or less abounds.

The quantity of coals annually dug in the Netherlands may be taken at about 60,000,000 metrical quintals of 100 kilograms each, the value of which at forty centimes the quintal is 24,000,000 francs (£960,000.) There were in 1822, in the four provinces we have mentioned, 93 great furnaces, 206 forges, 68 martinet houses (for hammering,) 19 foundries, 17 laminoirs or rolling houses, and 12 tin factories. Estimating the rough iron produced at 500,000 quintals, and the font or cast iron at 100,000 quintals, and valuing the wrought iron at 20, and the cast iron at 6 francs the quintal, we shall have a total value of 10,600,000 francs, (£424,000,) which we believe to be much under the mark, though from the depression complained of a little time back, we are fearful of overrating the quantity produced.

The fabrics of cloth and casimir are some of the most important, having a considerable sale not only in the kingdom, but in the North of Europe, and America. The principal seat of this industry is at Verviers and the neighbourhood, extending as far as Liege and Maestricht. Verviers has risen in a few years to a town of 16,000 inhabitants, and contains the extensive houses of Biolley and Son, Engler and Co. and others. It is carried on also in and near Antwerp, and particularly by De Vreede, Dieppen and Co. and Van Dooren and Co. at Tilbury in North Brabant; at Delft; and at Leyden for exportation to the East Indies. The Netherlands cloths are much sought for, both from their quality and price, and might have been formidable rivals to our own, had it not been for the timely reduction of the wool duty. It is difficult to ascertain the quantity made with exactness, but in calculating the home consumption of woollens at twenty francs per head for a population of six millions, who use at least one-third of home manufactures, and adding to this third an equal amount for exportation, the value of the cloth manufacture will be 80,000,000 francs a year.

The linen manufacture flourished in Holland in very ancient times, and linen cloth of beautiful whiteness and fineness is still made at Bois-le-Duc, Endhoven, and Gehmert. The table linen of Helmont, of Bruges, and of Courtrai, is remarkable for the elegance of its designs and the fineness of its texture. The sail cloth of Holland and Flanders, the ticking of Turnhout, and the bâstise of Ghent, are well known, as are also the threads, for sewing and for lace, of Termoude, Ghent, Brussels, Courtrai, &c. The bleaching grounds of Harlem and Courtrai are the principal. The linen manufactures are chiefly in Flanders; among the exhibitors in 1820 at Harlem, Messrs. De Cercq, Bleeckere, De Vos, Robetti, Verheyden, and others, residing in these provinces, were distinguished; M. de Beer, of Ghent, sent there a piece of cloth of four ells in width; and the specimens of M. Plankaert, of Courtrai, also excited much attention.

There are in East Flanders 31,697 looms employed in weaving flax, 6124 for cotton, and 639 for mixed stuffs. Audenarde and St. Nicholas are the districts in which flax is chiefly cultivated; the latter alone contains 3800 bonniers sown within it, which yields about two million pounds a year, one-third of it being exported to England and elsewhere. It is in the cottages of the small proprietors, owning

from 3 to 5 bonniers, that the machines are mostly in motion, because they employ the evening of themselves and their families in a kind of work which it is often not worth while for the large farmers to hire people to do. Independence and industrious habits are thus acquired by a numerous peasantry, who bring to market the stuffs manufactured by themselves from the produce of their own ground. The linen manufacture is, no doubt, capable of still further extension, and if the plan proposed by some influential persons in Flanders can be effected, for raising a fund to advance money to the peasantry for the purchase of machinery, and to establish additional markets for the greater convenience of sale, the people of these districts may make their labours even more productive than at present, and use their boys to the loom and their girls to the spinning wheel from their earliest years. The linen trade with France has been much checked by the high duties in that country, amounting to 20 per cent. on unbleached and 40 per cent. on bleached linen. Hence many bleaching establishments have been removed into France, and it is a common thing for the weavers who reside near the frontier to cross it to perform their work, so as to obtain the advantage of sale in France free from the excessive duty. However, the Netherlands weavers have no great reason to complain of their situation, for it appears that in East Flanders alone the average market sale of linens for the last ten years has amounted to 177,385 pieces, and adding one-tenth for the quantity disposed of by hawkers, 195,124 pieces. The price of the flax varying from 50 to 135 cents the pound, the value of each piece may be taken not unfairly at 35 florins, so that the produce of the linen manufacture in one province only is 6,829,340 florins; the profit, at the low rate of 2 florins the piece, 390,284 florins.

The following table will show the progressive increase in East Flanders for ten years, according to the returns of the nine principal markets for that province.*

Number of Pieces of Linen sold in

	1816.	1820.	1825.
Ghent	56,923	60,281	55,650
Alost	35,000	35,000	35,000
Rousse	31,200	31,919	34,570
Oudenarde	21,000	22,500	24,000
Geerartsbergen	15,000	19,000	24,000
Lokeren	3,640	3,363	4,576
Deynse	2,400
Wetteren	2,390
Sotteghem	1,700	1,900	2,100
	<hr/> 16,4463	<hr/> 173,763	<hr/> 184,686

* Proef op de aanmoediging en uitbreiding der Linnenweveryen in Oost Vlaanderen, door Ir. A. J. L. Van den Bogaerde, Beschryver van het Distrikt St. Nicholas, voorheen Land van Waes. Te Gent. 1829. (Essay on the Encouragement and Extension of the Linen-weaving in East Flanders, by Mr. A. J. L. Van den Bogaerde, Overseer of the District of St. Nicholas, for the Land of Waes. At Ghent, 1829.)

The tendency of the linen manufactures to spread from towns into the smallest villages, is favourable to their increase, and they are, we believe, generally thriving in other parts of the country, particularly in Hainault and Friesland. Judging from the annual production and importation of hemp and flax, the value of these manufactures, including the bleaching and every necessary ingredient of completion, cannot be less than 105 to 115,000,000 florins:

The lace trade has, we understand, not much augmented of late years; but the three sorts, those of Brussels, of Mechin, and of Valenciennes, retain all the delicacy and richness for which they have long been famed. MM. Ducpetiaux, Galler-Liegeois, Meeus-Vanderborcht, Verbecht-Haye, Vispoel, Deliagre, Van Pèteghem, &c. have sustained the reputation of their several cities by the specimens exhibited at Ghent and Harlem. The cheapness of tulle in France, where it is now made to a great extent, (a proof of which may be seen at Calais, where upwards of 5000 people are employed in it,) has probably interfered with the demand in that country for the more costly work of the Netherlands.

The rise of the cotton trade, or rather its resurrection, since the termination, at the peace, of Napoleon's prohibitory system (which forced it here as well as in France beyond all reasonable bounds) is very striking. The spinning establishments are principally in East Flanders and Brabant; and stuffs of all kinds, calicoes, ginghams, perkales, and printed goods are made in abundance at Ghent, Brussels, Antwerp, Courtrai, Bruges, Ypres, Lokeren, and St. Nicholas. At the exhibition of 1820 there were 35 exhibitors of cotton stuffs, and at that of 1825, 66, and although the manufacturers were not particularly forward in displaying their products, yet some of the principal houses had no reason to regret their doing so, among whom were M. Basse, of Brussels; MM. Davis, and Engler and Co. also of Brussels; MM. Godefroid, Poelaert, Poelman, and Feroucke; De Smet, De Vos, De Vos-Bauwens, Vander Waerden and Co., and Sauvage and Co. of Ghent, and many other manufacturers equally well known. It is at Ghent in particular that this trade flourishes, as may be judged by the fact of its containing 68 steam engines for spinning and weaving, while 25 years ago there was not one in all Flanders, the first having been erected by Messrs. Edwards in 1805. Ghent receives annually 40,000 bales of cotton wool, and the new canal, intended to communicate with the Scheldt at Terneuzen, will give additional facilities for procuring the raw material. The price of labour is very low at Ghent, compared not only with other countries, but with other parts of the Netherlands; it being but 15 sous a day, while at Antwerp it is 26 sous. The necessity of purchasing from England is almost superseded; and in spinning cotton of the low numbers, from 20 to 40, the manufacturers can already compete with us; a circumstance of some moment, considering the large quantity of cotton of this description we supply annually to the north of Europe.

These favourable circumstances have also contributed to the success of the sugar refineries at Ghent and in the neighbourhood, which

have been on the decline at Amsterdam and Rotterdam. About twelve million pounds of sugar are annually refined in the first mentioned city.

The distilleries of Holland are in a very prosperous state, and the name of Shiedam appears to retain its fame throughout the world. The circumstances of the distilleries thriving better here than in the corn provinces of Belgium, may be accounted for by the facilities of exportation from Rotterdam, the fact being that $\frac{9\frac{3}{4}}{100}$ ths of the Geneva made at Schiedam are sent to the East Indies. This Geneva acquires a mildness and an oily flavour as it grows old, which the Hollanders are said to dislike; it is made solely of the spirit of rye and barley, flavoured with juniper berries. There are 300 distilleries at Schiedam, 100 in other parts of Holland, and about 40 in the other northern provinces; the average produce of each is 4992 ankers a year, which gives a total of 2,152,762 ankers. Deducting, however, a third, and estimating the distillation at 1,400,000 ankers, this branch of industry will be found to produce about 34,000,000 francs, of which about two-thirds are exported. This calculation, however, only extends to the northern provinces, as we have not the means of making an estimate for Belgium, where the distilleries are comparatively few and inactive.

A vast number of hands are employed in Holland in brick making, particularly at Utrecht and Dordrecht. These bricks are used not only for building, but for the roads which present so curious an appearance to strangers, and would indeed be but ill calculated for their purpose, did not all merchandize, and $\frac{1\frac{2}{3}}{100}$ ths of the passengers travel on the canals. The figures in which they are laid down are not less striking than their colours; they are about 7 inches long, $3\frac{1}{2}$ wide, and $1\frac{1}{2}$ in thickness.

We should hardly be expected to notice the breweries, did not their trade extend far beyond that of home consumption. "La bonne biere de Louvain" is exported in large quantities; there are between 30 and 40 breweries in that city, which make about 4000 tuns each monthly. Brussels has above 40 breweries, and Mechlin 25; which latter are famous for the kind of ale called Faro. The consumption in the kingdom may be reckoned at $2\frac{1}{2}$ cents a head; and of the two sorts of beer in ordinary use, the better is 11 cents (less than 2*d.*) and the inferior 7 cents (less than $1\frac{1}{4}$ *d.*) per pint. Both of them are perfectly wholesome, and though perhaps dearer than they ought to be, are not so heavily taxed as to drive the people to the abominable refuge of spirit drinking—now one of the fertile sources of crime and misery in England.

As we have now spoken of those branches of manufactures which appeared to require special mention, we shall conclude the subject with a table of the value of the present manufacturing industry of the kingdom, according to its various divisions. If our authorities should have, in any instances, led us into error, it is assuredly without the slightest inclination on our part either to exaggerate or diminish.

State of the present manufacturing Industry of the Netherlands.

Substances.	Value in Fr.	Substances.	Value in Fr.
Iron*	46,000,000	Brought over	606,000,000
Copper	5,000,000	Dying	10,000,000
Woollens	80,000,000	Paper	8,000,000
Linens	95,000,000	Caps and Bonnets 	7,000,000
Cottons†	50,000,000	Cheese	10,000,000
Sugar (refined)	14,000,000	Jewellery	4,000,000
Salt (do.)	10,000,000	Starch	3,500,000
Spirits‡	40,000,000	Acids and Salts	1,500,000
Beer	110,000,000	Cordage	3,000,000
Tobacco§	28,000,000	Hats	6,000,000
Oil	30,000,000	Glass	2,000,000
Soap	10,000,000	Clocks	4,000,000
Lace	25,000,000	Cards	1,200,000
Leather	28,000,000	Embroidery	1,200,000
Earthenware and Pottery	4,000,000	Turnery	600,000
Bricks and Tiles	6,000,000	Lead and Zinc	1,000,000
Printing and Books	15,000,000	Miscellaneous	4,000,000
Bleaching	10,000,000		
	<hr/> 606,000,000	Total¶	673,000,000

The sum, therefore, of the manufacturing industry of the Netherlands amounts to 673 million francs, or £28,125,000 sterling per annum, of which we may state one-third to be composed of the profits of the labourer and the capitalist, according to M. de Cloet's calculation. The artisans in the country are about 13,000, and those in towns about 77,000, in all 90,000; whose wages at 1½ franc a day (which, perhaps, rather exceeds the average) for 300 days, amount to 40,500,000 francs per annum. Deducting this sum from 225,000,000, the third of the total value, there remains a profit to the manufacturer of 184,500,000 francs, or about 28 per cent. on the gross produce, including the interest upon his capital and stock.

NOTICE.

THE distance between the editor and the printer frequently interferes with the insertion of some small articles reserved for the "make up;" this, and the space occupied by the index, prevents the publication in the present number of several notices of books, which the editor had prepared for insertion; they shall appear hereafter. From two quarters he has received letters requesting his opinion of the value of the *Encyclopedia Americana*; he has now only space to say, those who would be induced to subscribe for it in consequence of his favourable judgment, need not delay. There are few who will not find something to interest and instruct them on every page.

* Including 24 millions of cutlery, hardware, and nails.

† Including the several branches of spinning, weaving, and printing.

‡ Reckoning only 6 millions for Belgium.

§ Estimating the consumers at 2 millions at 7 lbs. each, and the exportation at an equal amount.

|| Of woollen, linen, and cotton.

¶ M. de Cloet makes it, in 1824, 600 millions.

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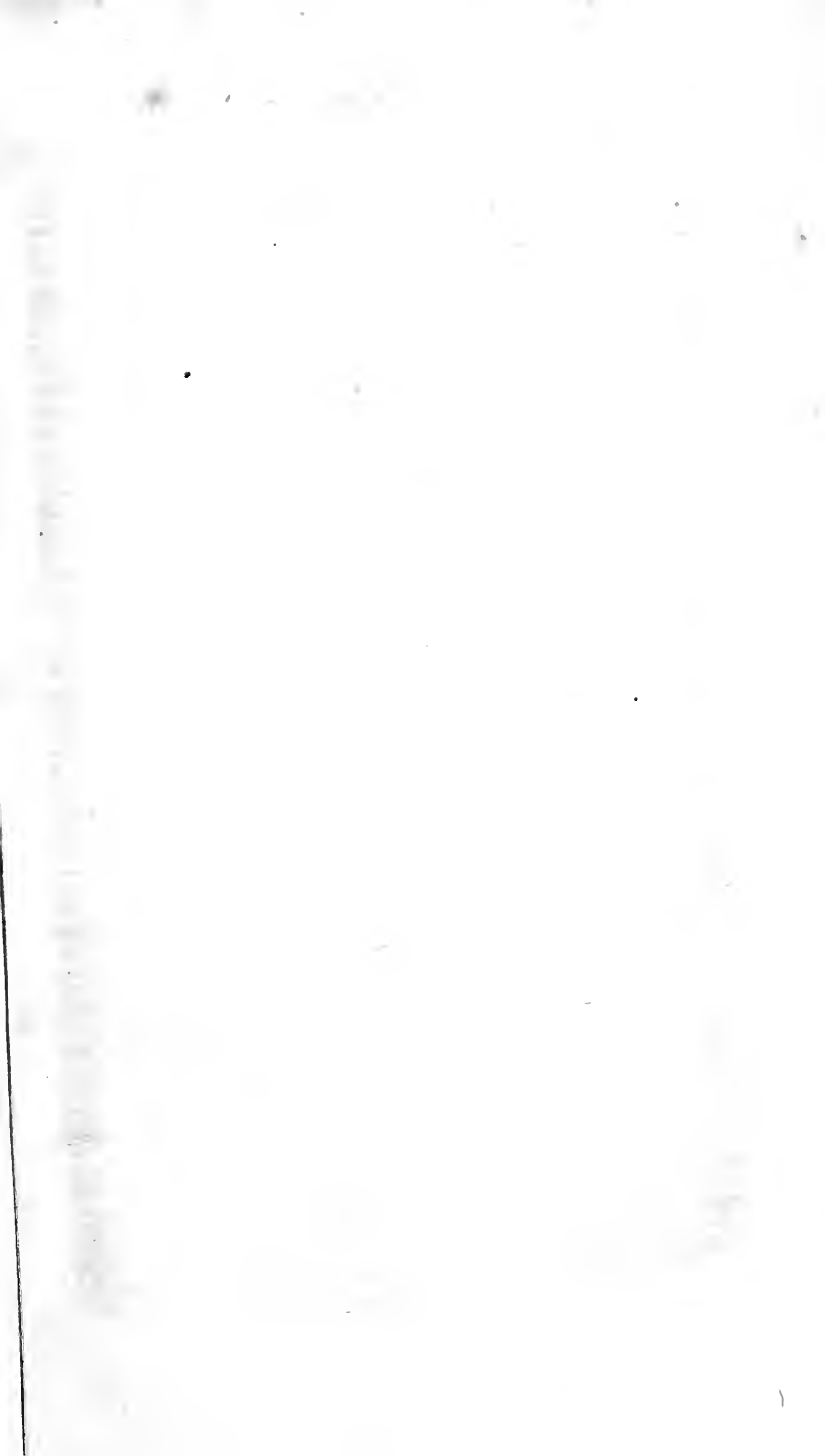
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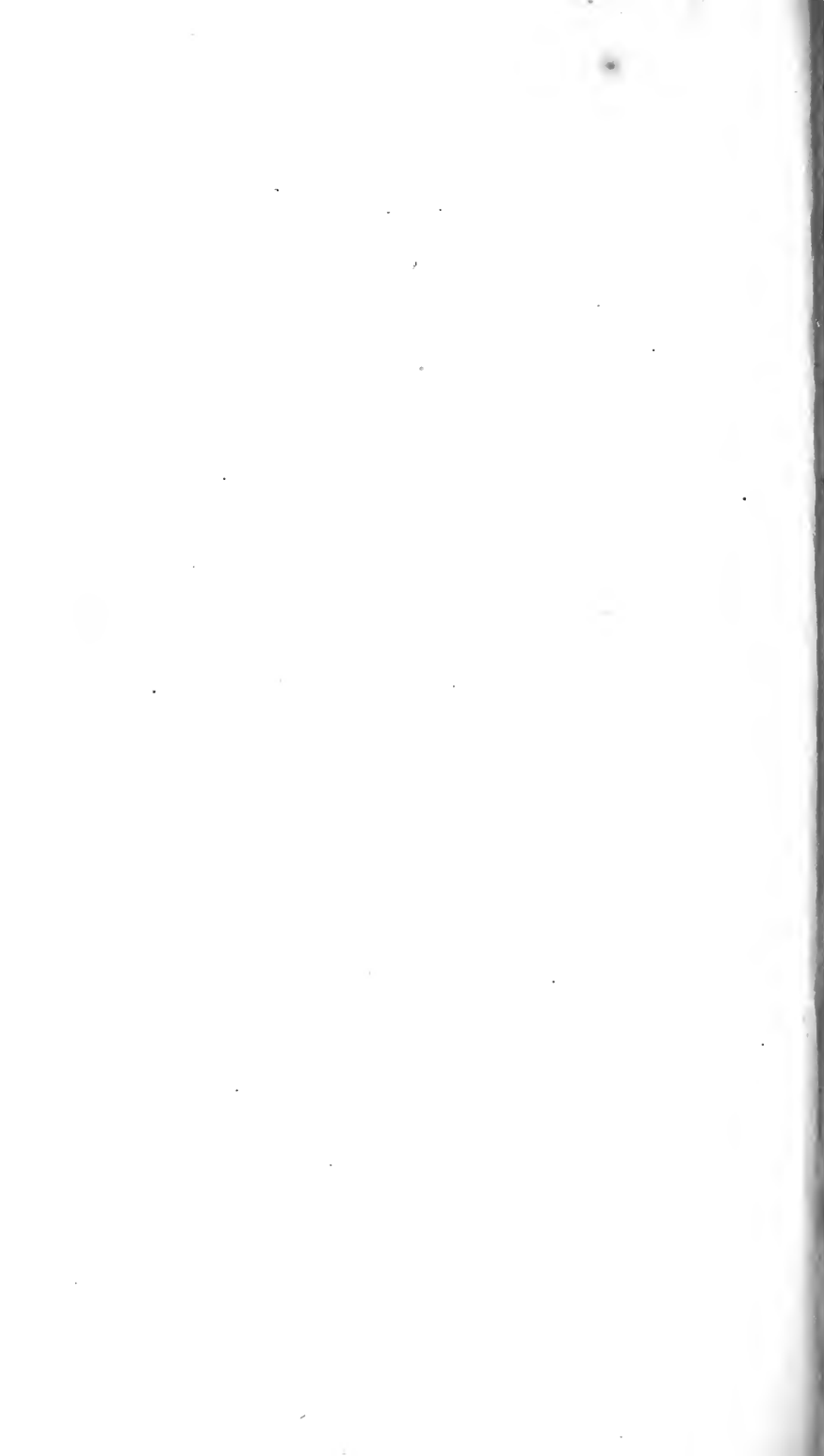
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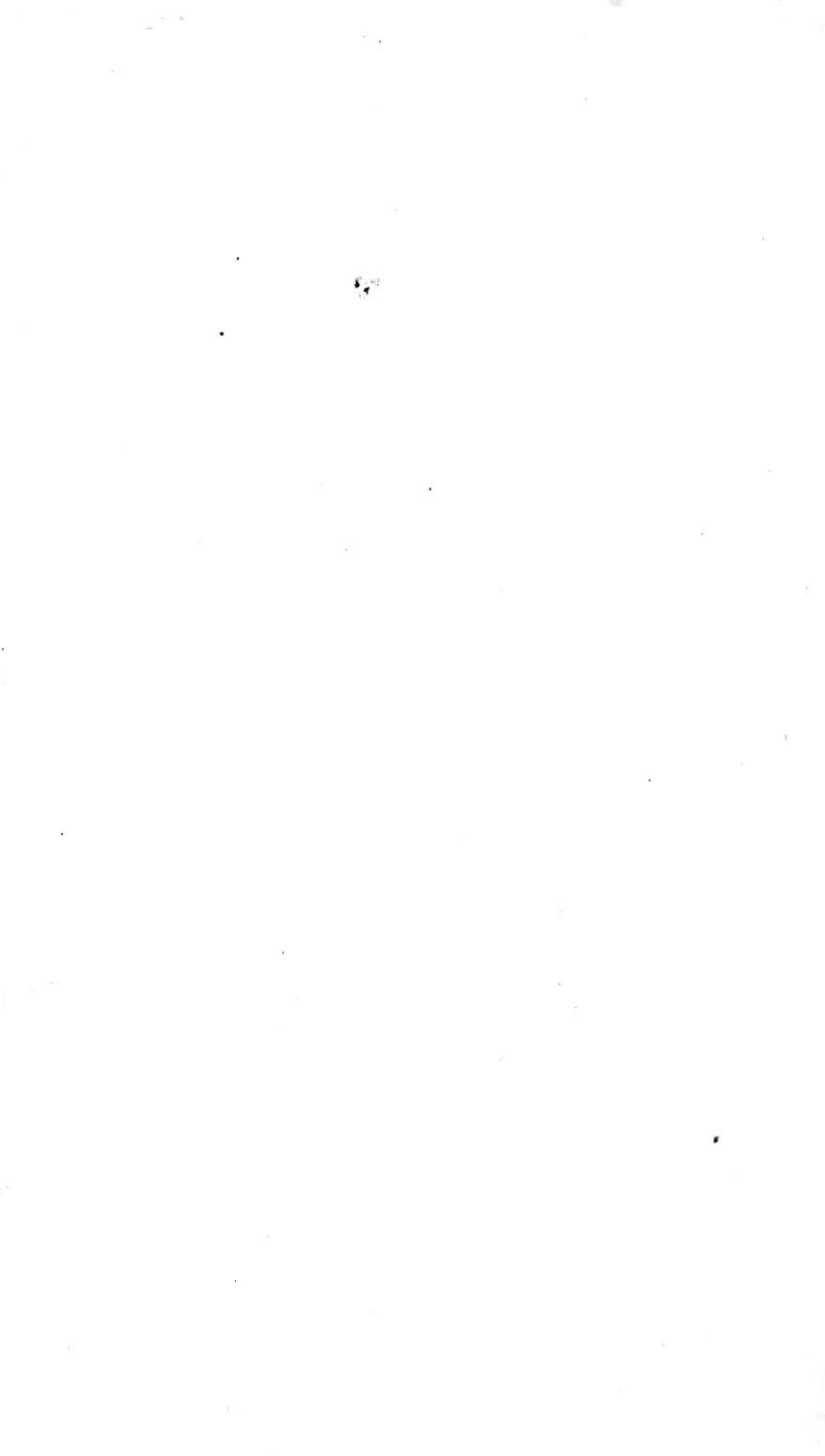
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